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WHY THE ELECTRIC VEHICLE IS GAINING RECOGNITION.

The increasing popular interest in the electric vehicle was one of the most conspicuous features of the recent automobile shows at New York, Chicago and Boston. This is a very gratifying situation, and it shows that a great deal of the hard work lately done by manufacturing and central-station interests is bearing fruit, after many discouraging vicissitudes. Vice-president Mansfield, of the Electric Vehicle Club of Boston, recently announced that the number of electric commercial and pleasure vehicles sold in Massachusetts has increased about 58 per cent in the past year, as indicated by the Highway Commission register, and there is no doubt that a large part of this gain is due to the time and money which the Boston Edison Company and the dealers and manufacturers working in its territory have put into the battle against conservatism engendered by unfortunate early experiences with equipment not nearly so well developed and applied as that now operating in most of the large cities of the country.

It is needless to catalog in detail the advantages of the electric vehicle within its special field, so far as electrical men are concerned, but it is important to keep everlastingly at the task of bringing home to the public the points wherein it excels. The automobile shows have done a great deal to further this, but the daily service of machines on the streets is the final test. In this connection we believe that the use of the word "electric" on every vehicle of this type is doing more to call the attention of the public to the practicability of such equipments than any other form of advertising. Every central station owning an electric pleasure car or truck should look out for this and paint the words "operated by electricity," or other suitable designation on the battery box or some equivalent location which cannot fail to be seen by observant persons on the streets. It is a fact that this specialized publicity is gradually familiarizing the public with the distinctive operation of electric machines as contrasted with gasoline cars, to an extent that often causes one to overhear comment on the streets favorable to the former type of quiet-running equipments.

The appeal of the electric vehicle is louder this year than ever before for many reasons, the chief of which are the improved quality and finish of the productions now on the market, the simplicity of control and of mechanism offered, and the increased mileage now possible per charge of battery. The radius of action is being noticeably extended, and every owner of a

first-class 1912 electric roadster finds himself the possessor of from 100 to 150 miles of potential travel every time the battery leaves the garage, and at speeds of from ten to twenty miles per hour on average roads. The reliability of these machines with reasonable care is literally unsurpassed, and they must now be reckoned with as factors in any suburban touring proposition. The attention being paid to such matters as suspension, interior finish, appearance, weight, wheel bases, tire sizes, reduction of driving friction, and flexibility of handling is bringing its own reward. No one has any excuse now for going into an automobile show and picking out the electric machines as the butts of ridicule. That has been done in the past, but the progress of the industry has lately left all that far behind, and the man who desires to spend three or four thousand dollars on a convenient and comfortable car for service in and near town can find as much luxury in the electric designs as in the most noted gasoline makes. The first cost of the electrics tends to run a little too close to the medium-priced gasoline cars to attract the customer of very moderate means at the present time, but when all the points are considered, and allowances made for depreciation and repairs, the electric-vehicle owner is bound to find out that first cost is by no means the controlling factor. As more cars are purchased, also, the chances are that prices will be forthcoming on popular makes which will place such machines in the hands of many persons who at present find the initial investment an obstacle to ownership.

MINNESOTA ELECTRIC ASSOCIATION.

The fifth annual convention of the Minnesota Electric Association, while hardly being the most successful in the history of the Association, was nevertheless an important one in many respects. Through the efforts of Mr. Ludwig Kemper, president, a very excellent program was provided, and while the discussions were not entered into as fully as might have been hoped for, many interesting points were brought out and the benefits therefrom would be hard to estimate.

Of particular interest was the paper and discussion on the subject of "How to Increase Revenue in Small Towns." The discussion dealt largely with the results being obtained in increasing the day load, particularly in the smaller towns, and while encouraging reports were heard from many, still several companies are not deriving the maximum benefits from 24-hour service. In this connection it is well to call attention again to the increasing popularity of ice-making and central-station steam heating as means of utilizing exhaust steam during both the summer and winter months, and thereby materially increasing the revenue.

The utilization of central-station plant for the manufacture of ice is a practice that has assumed large proportions and is increasing at a rapid rate. In fact in many instances the revenue from the ice business, conducted only a portion of the year, equals and in some cases exceeds, the returns from the electric business conducted without interruption.

Of central-station steam heating more is known and experience has demonstrated that satisfactory returns are obtained where local conditions have been studied and a system installed best-suited for the service it is called upon to perform.

Considerable reliable data are now available on both ice-making and district heating and the possibilities of each for local utilization can readily be determined. Unless a study of the conditions should prove that the installation of an ice-making or steam-heating equipment is not feasible, central stations have no excuse for maintaining day service at a loss.

LEGISLATION TO CONTROL WIRELESS.

At the international wireless convention held in Berlin in 1906 regulations were adopted for the world-wide control of the wireless telegraph. The regulations then drawn up have since been approved by the governments of a large number of European nations. So far the United States has not given its adherence to the formulations of that convention. In consequence of this the United States Government has been omitted from the list of those invited to participate in the second convention which is to be held this year.

Bills have been introduced in Congress from time to time looking to the regulation of wireless operation in this country. Action is now pending upon one such bill which has the endorsement of the administration, which would give power to the Secretary of Commerce and Labor to make regulations governing the operation of all wireless apparatus. He would thus be in a position to make any regulations which were adopted by international conventions operative in this country.

Naturally the concentration of power in a single official to entirely dominate activities in any industry has met with opposition from the commercial interests involved, and with very good reason. Since such complete authority is given to the Secretary of Commerce and Labor, any man occupying this position could if he saw fit make regulations which would be very onerous upon operating wireless companies and it would open the door to considerable discrimination, especially if the assignment of particular wave-lengths to particular companies should be adopted. Undoubtedly one of the restrictions which would be made would be to reserve certain wave-lengths for the use of the government departments, such as the Army and Navy, and restricting commercial operators to certain other wave-lengths. While some such arrangement would undoubtedly be very beneficial to all concerned, it is questionable whether it is advisable to leave complete authority in the matter in the hands of a single official.

The position of the amateur in the case of such regulations would not be at all unfavorable. Deliberate interference with the receiving of commercial, of government and of distress messages would no doubt be penalized, but his action in his legitimate field would probably not be restricted, except in the matter of wave-lengths. In the case of apparatus of limited power whose sphere of influence was entirely within the borders of a single state, it is questionable whether any federal restrictions would be operative, since the power of Congress to control in this matter would rest upon its constitutional authority over interstate commerce.

Some kind of legislation tending to improve the chaotic conditions which may otherwise exist in wireless operation is certainly to be desired, but it would seem that some better method of control could be adopted than that of leaving authority to promulgate regulations in the hands of a single government official.

TECHNICAL TRAINING FOR THE SALESMAN.

A writer in a current number of one of the trade journals feels aggrieved, it seems, on account of what he considers a disposition in the industrial world to place undue emphasis on the importance of salesmanship. He objects particularly to a statement which it appears that somebody has made to the effect that salesmanship is nine-tenths of modern business. While such an estimate as this is doubtless putting the matter too strongly, high-class salesmanship is certainly very important to industrial progress, and one should feel encouraged by the present rather general tendency toward a due appreciation of its value and importance. In many ways, this recognition is something new. In quite a large portion of the electrical field, for example, it was true not very long ago that selling, so far as the salesman himself was concerned, was but little more than order taking. The customer was often left to discover his needs for himself, the salesman doing scarcely more than undertaking to see that these were supplied when they had been made known to him.

Coincident with the recent very widespread adoption of more systematic and persistent methods of finding a market for electric commodities, there have arisen some very pertinent and interesting questions relative to the qualifications necessary to assure the electrical salesman the largest measure of success in his work. These questions, it may be explained, hinge mainly about the matter of technical education for the salesman. That good address, energy, an optimistic temperament, and other similar personal traits are qualifications indispensable to the success of any salesman, no one who has given the matter any considerable amount of study would for a moment doubt; but as to what extent the electrical salesman needs or should employ technical knowledge of the commodity whose use he is endeavoring to promote, there is not nearly so much unanimity of opinion.

There are men, for instance, who without other engineering training than that which they have been able to acquire in the routine of their vocation, have, by sheer force of persistent effort, become successful on the sales end of the electrical industry. These men are often inclined to discount the value of technical information as a means of securing orders. They seem to fear that any considerable amount of knowledge of this kind may tend to promote a misguided sense of intellectual superiority on the part of the salesman not at all conducive to the patient effort sometimes necessary in order to make sales; or it may be felt that such information is liable to be used in such a way as to confuse the customer rather than arouse his interest and secure his confidence. It is doubtless true that such apprehensions as these are not always unfounded. It is not improbable, however, that the electrical trade suffers much more from a lack of technical training on the part of salesmen than from any excessive information along this line. The situation in the electrical field is a rather unique one. Being neither electricians nor engineers, the public must necessarily depend upon the salesman in a large measure for information as to the real possibilities and benefits of electric service or of any new appliance. Obviously this information can best be supplied by the salesman who is well informed on the subject himself. It may be added, too, that no conscientious salesman can attain the greatest success in promoting the adoption of any commodity unless he has faith in the superiority of the thing whose use he wishes to promote. Ignorance as to the real nature of the thing to be sold must necessarily seriously handicap the salesman. Add to the requisites already suggested patience, confidence in one's self and belief in the goods to be offered to the consumer, and we have most of the important elements of successful salesmanship. Other opinions to the contrary notwithstanding, the last of these qualifications is by no means the least necessary. The others may be native, but this particular one can best be acquired by well ordered study and instruction, rather than wholly through experience or by chance.

A rather convincing illustration of the value to the salesman of technical familiarity with his line may be found in the field of artificial lighting. While other causes have not been inoperative, to be sure, the very great increase in the popularity of electricity as an illuminant which has occurred within the last two or three years has been in no small measure due to the fact that the manufacturers of electric lamps and other lighting supplies have kept the field supplied with salesmen who have been taught how lamps are made and also the fundamentals of correct illumination. From the standpoint of the public—and doubtless from that of these manufacturers, too—the money the manufacturers have spent has been a most fortunate investment. Similar zeal for the education of salesmen handling any other electrical product may be expected to prove equally profitable.

Convention of American Railway Engineering Association.

An event of much interest and importance was the thirteenth annual convention of the American Railway Engineering Association which was held in Chicago last week. The meetings began on Tuesday, March 19, and continued during that and the two following days. There were present 391 members, among these being men prominent in railway affairs from all sections of the country. The sessions were devoted entirely to the consideration of the reports of committees on various engineering problems incident to the construction, maintenance and operation of railroad lines and systems.

From the viewpoint of the electrician, the most interesting of the above reports was that of the Committee on Electricity, of which George W. Kittredge, chief engineer of the New York Central Railroad, is the chairman. This report was concerned mainly with third-rail clearances for electric roads and with specifications for overhead crossings where electric light and power lines cross railroads. A list of 79 specifications relative to this latter matter was presented and approved. It was explained that in the preparation of these the Committee had had the co-operation of the National Electric Light Association, the American Institute of Electrical Engineers, and other electrical interests.

Among other things, the Committee recommended that where wooden poles support a span of wire over railroad tracks they be side-guyed in both directions, if practicable, and head-guyed away from the tracks. Also, the next adjacent pole on both sides of the road should be head-guyed in both directions. Where wooden cross-arms are employed on a line whose voltage is over 5,000, the arms on the two poles at the ends of the span should be thoroughly grounded. The conductivity of the ground wire should not be less than that of No. 4 B. & S. gauge copper wire. The minimum diameter of poles, at the top, should not be less than seven inches. For pressures of 5,000 volts or more, porcelain insulators should be used and the insulator pins should be steel or some other approved metal. Conductors smaller than No. 6 B. & S. gauge, the report specified, should not be used in the transmission of electric current across a railroad. All aluminum conductors used for this purpose must be stranded. Where the line voltage is 750 or less, copper conductors in sizes up to 4/0 may be either stranded or solid; larger conductors must be of stranded construction for these voltages. For voltages between 750 and 5,000 solid copper wires may be used in sizes up to and including 2/0, but above 2/0 in size, only stranded wires must be used. If the voltage exceeds 5,000, only stranded conductors should be employed, whatever their size. Copper conductors smaller than No. 4 B. & S. gauge should not be used in crossing if the line pressure exceeds 5,000 volts. The method of installation must be such that the breaking of insulators will not result in the falling of wires.

The report of the Committee also covered rather completely such other matters as the minimum clearances between conductors and tracks, methods of testing line materials for making crossings, and so on. In view of the constantly increasing number of high-tension lines crossing railroads, the recommendations of the Committee proved to be particularly interesting to the convention.

Allis-Chalmers Reorganization.

Under the reorganization plan of the Allis-Chalmers Company, as made public on March 20, a new corporation is to be formed with a capital stock of $42,500,000, consisting of $26,000,000 common and $16,500,000 seven-per-cent cumulative preferred. The latter is to be cumulative five per cent from January 1, 1913, six per cent from January 1, 1915, and seven per cent from January 1, 1917, but will be entitled to seven per cent from the beginning in case it is earned. If found practicable, the new preferred stock will be given power to elect a majority of the board of directors and is to be redeemable at 110. It will be distributed as follows: Five-per cent bondholders, $11,148,000; stockholders or underwriters on payment of assessments, $5,192,000, and surplus of $160,000.

The distribution of the common stock is to be as follows: five-per-cent bondholders, 35 per cent of holdings in consideration of release of lien and fixed charges, $3,901,800; old preferred stock, 90 per cent of holdings, $14,445,000; old common stock, 35 per cent of holdings, $6,937,000, and surplus, $716,200.

Present holders of Allis-Chalmers securities will receive new stock in exchange on the following basis: for each $1,000 five-per-cent bond a total value of $1,375, of which $1,000 new preferred, $350 new common and $25 coupon January 1 in cash; for each $100 par preferred stock upon payment of $20 in cash a total value of $110, of which $20 will be new preferred and $90 new common; for each $100 par value of common stock, a total value of $45, of which $10 will be in new preferred stock for $10 assessment and $35 in new common stock. A voting trust of new preferred and common stock is to be created for five years with five voting trustees, to be appointed by the following reorganization committee: James M. Wallace, chairman; C. W. Cox, A. J. Hemphill, R. W. Leigh, J. H. McClement, W. E. Roosevelt and F. Vogel, Jr. It is planned also to obtain a friendly receiver, but he will probably not be named before April.

Street Lighting.

On March 14, H. H. Magdsick, of the Engineering Department, National Electric Lamp Association, Cleveland, O., addressed the Nela Engineering Society on the subject, "Gas, Gasoline, Arc and Incandescent Street Lighting." Mr. Magdsick discussed in detail the requirements of good illumination, for different classes of thoroughfares, from both utilitarian and decorative points of view. Data on the comparative costs of various illuminants were given.

Mr. Magdsick advocated the use of incandescent electric lamps in an upright position in ornamental lighting system, if the decorative value of the installation can be enacted thereby. Readings of intensities taken along the line of posts and along a line 14 feet out from the line of posts show that, 25 feet from the standard, the intensities for pendent and upright units are identical, thus indicating that the minimum intensities are the same for both types of installations. The pendent unit affords a higher intensity at the standard than does the upright unit, but the greater uniformity of intensity from an upright unit has the advantage of preserving the dark adaptation of the eye.

Philadelphia Section Meeting.

The regular monthly meeting of the Philadelphia Section of the Illuminating Engineering Society was held on Friday, March 15, the usual dinner preceding the meeting.

The meeting was called to order by J. D. Israel, with 153 members and visitors in attendance. The secretary read abstracts from the minutes of the General Council held in New York, also of the New York and Chicago Section meetings.

Professor Rowland delivered the third of his series of educational talks, "Shades and Redistribution of Light." This paper was illustrated by lantern slides and practical demonstrations.

Herbert E. Ives, of Cleveland, delivered a paper on "The Application of Photography to Photometric Problems."

Clayton A. Sharp gave an extemporaneous talk on "Some Casual Observations of European Lighting."

Philip Stevens Dodd.

Among the younger men prominent in the electrical industry few are better and more favorably known than Philip Stevens Dodd. "Phil," as he is popularly known, has a faculty of looking at the world through colored glasses and reflecting the sunshine of good cheer and optimism into every situation, sinister or otherwise. In the brief span of ten years, which covers practically his connection with the electrical industry, he has made a host of friends, attracted the attention of big people, and made good in several different undertakings which might well have exhausted the resources of men much more mature and experienced in the battle of life.

Mr. Dodd's earliest business connection of an important nature was with the Washington Life Insurance Company, of New York, with which organization he spent four years. For two years following this connection he was sales manager of the National Roller Company, manufacturers of printers' supplies. Then followed two years of active work as a newspaper man with the New York *Journal*. In April, 1902, he became connected with the business department of the ELECTRICAL REVIEW in New York, and upon its absorption of the *Western Electrician* and the removal of the publication office to Chicago, he became acting manager. During his connection with this organization Mr. Dodd made a wide acquaintance throughout the electrical field, his ready wit, sparkling good humor, and natural attractiveness making him a favorite wherever he was found in a gathering of men of the right sort. Among the manufacturers of incandescent lamps, and particularly among the managers of the companies of the National Electric Lamp Association, he made many firm friends and attracted the attention of such men as A. D. Page, of the General Electric Company, F. S. Terry, B. G. Tremaine, A. S. Terry, J. Robert Crouse, and the late lamented F. P. Fish. This led to Mr. Dodd being offered the position of Director of the Department of Publicity, which was then being considered by the National Electric Lamp Association. Mr. Dodd accepted this position, resigning from the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN in July, 1909.

Philip Stevens Dodd,
Secretary of Commercial Section, N. E. L. A.

His first work with the National Association was the organizing of the Department of Publicity. During the next summer, his success in organization being so marked, he was selected to direct the affairs of Camp Claverack, on Association Island, in the St. Lawrence River, the great summer colony owned and operated by officers of the constituent companies of the National Electric Lamp Association. Mr. Dodd took a bare island and converted it into the most delightful of summer recreation places, building a splendid club house, fine dock facilities, and establishing telephonic and telegraphic communication with the mainland of New York.

In addition to these duties, Mr. Dodd became an active participant in much of the missionary work carried on by the National Association in the developing of increased business.

Within the last year, however, Mr. Dodd's work has taken on a much broader aspect, and he has been devoting himself very sincerely to a great effort to bring about an active and practical realization of co-operative work among the various elements of the electrical industry. He has traveled from the Atlantic to the Pacific, from the Gulf to the Dakotas, making addresses, organizing luncheon clubs, assisting at rejuvenations of the Sons of Jove, interviewing editors of prominent dailies, and the leading men of the electrical fraternity in all the big cities preaching the gospel of co-operative development of our electrical resources. In this he has been successful, as the long list of organizations which are now pledged to this work amply indicates. A year ago he was elected secretary of the Commercial Section of the National Electric Light Association, and in this connection he is rapidly formulating and completing plans for the carrying out of work which will be truly of a helpful business-promoting nature. He has established an office in New York in close touch with the office of Secretary Martin, and there a busy organization is carrying out his ideas, building up a number of departments which will be of assistance to the Commercial Section of the National Electric Light Association, the infant branch of this great organization; so lusty, however, that it has shown within the few years of its conception, the most remarkable and satisfactory growth and progress.

Arrangements for Southwestern Association.

Extensive preparations are being made at San Antonio, Tex., for the reception and entertainment of the delegates and other visitors to the annual convention of the Southwestern Electrical and Gas Association, which is to be held April 25, 26 and 27. The local arrangements for the convention are in charge of W. B. Tuttle, vice-president and general manager of the San Antonio Gas and Electric Company. Mr. Tuttle's advices indicate that the attendance will be larger than any convention in the history of the Association. Besides the program of papers and the proceedings of the convention itself, there will be held in connection with the event one of the largest electrical shows ever given in Texas or the Southwest. Many applications for space have already been received from proposed exhibitors. The wonderful electrical development that is taking place in Texas and other territory covered by the Association is arousing great interest on the part of manufacturers and dealers in elec-

trical equipment and supplies. This accounts for the prospective large magnitude of the exhibition that is to be given. The illumination features of the electrical show will be specially attractive. An elaborate program of entertainment for the visitors is being arranged.

The Criminal Law in Illinois.

At a meeting of the Electric Club, Chicago, March 21, an address was delivered by B. J. Short on "The Criminal Law as Enforced in Illinois." The speaker has been assistant state's attorney in Cook County for six years and had excellent opportunities to become acquainted with the defects in criminal practice. He pointed out that the criminal code of Illinois was a century behind the times and the eccentricities of its technicalities interfered greatly with substantial justice and with the prompt disposal of cases.

The discussion consisted of a number of questions put to Mr. Short by members of the Club in regard to details of the subject.

The resignation of Perry Boole as vice-president was announced.

The meeting of the Club on March 14 was devoted principally to entertainment. F. P. Vose, who had just returned from a trip to the Panama Canal, spoke briefly upon the impressions which he had gained from his visit.

Tours to Seattle.

The Transportation Committee of the National Electric Light Association has made the following plans toward accommodating those attending the annual convention in Seattle, Wash., June 10 to 14. Special reduced fares have been authorized to Seattle from all points, in addition to which several special tours have been arranged.

Tour A.—This is a complete circular tour with all expenses paid. Train No. 1, known as the Red Special, will start from New York, and Train No. 2, the Blue Special, will start from Boston. Beyond Kansas City the routes will be the same and include stops at the Grand Canyon of Arizona, at points in Southern California and at San Francisco on the going trip. The return trip will include Yellowstone Park, Salt Lake City and various points in Colorado. These two trains will start May 26 and get back June 29.

Tour B.—This comprises the going trip only with all expenses paid. The Pink Special will leave New York June 3 and the Green Special will leave Chicago June 4, and the route is *via* the Canadian Pacific Railway.

Tour C.—This comprises only the going trip and includes only the railway fare. The Orange Special will leave Chicago on June 6, and the route is by way of the Chicago, Milwaukee & Puget Sound Railway.

Tour D.—Similar to Tour C. The Purple Special will leave St. Louis June 5 by way of the Burlington and Great Northern Railroads.

Special arrangements will be made for an Alaskan trip if sufficient reservations are secured.

It is imperative that all those intending to avail themselves of these trips should give immediate attention to securing accommodations. Full information can be obtained from the chairman of the committee, C. H. Hodskinson, 70 State Street, Boston, Mass.

Influence of Spectral Character of Light on Acuity of Vision.

A meeting of the Chicago Section of the Illuminating Engineering Society was held on the evening of March 21 at the Great Northern Hotel, Chicago. M. Luckiesh, of the National Electric Lamp Association, Cleveland, O., presented a paper entitled "The Influence of Spectral Character of Light on the Effectiveness of Illumination."

At the outset of his paper Mr. Luckiesh explained what is meant by chromatic aberration and showed that the eye is not achromatic. This would indicate that monochromatic light should produce a better defined image than light of an extended spectral character. Dr. Bell's experiments verified this as to mercury-vapor light and Mr. Luckiesh's tests confirmed it more conclusively. This point being established, he undertook a series of tests to ascertain in which monochromatic light acuity was greatest, the same intensity being used for the different colors; this was found to be in the yellow region of the spectrum. Unfortunately, though this light would give the greatest defining power, it would distort color values so badly as to make its practical use limited.

Other conclusions that Mr. Luckiesh reached as the result of his investigation are as follows: Visual acuity varies much more slowly than brightness, varying in arithmetical ratio when brightness is varied in geometrical ratio. For equal brightness variations, acuity changes more in light from the extremes of the spectrum than it does in light from the middle region. The accommodating power of the eye is of importance in determining visual acuity in lights of different colors. For near vision blue light is more readily focused while for distant vision the eye focuses red light with greatest ease. However, for normal reading distances there seems to be no discernible difference in the ability to focus lights of different colors. It would be desirable in certain cases to use the acuity method in determining the effectiveness of an illumination, but its extreme insensibility and the variation in the readings of different observers are against its use for practical purposes. In these cases the most practical method will be found in the use of an ordinary brightness photometer for measuring illumination and assigning a constant (determined through investigation) which depends on the illuminant, its position, surroundings, etc. In many cases, however, the usual photometric methods are more just than the acuity method. At the same illumination it is probable that the revealing power of most artificial illuminants of extended spectral character will not differ by a measurable amount.

Chairman R. F. Schuchardt opened the discussion by calling attention to the importance of the investigation undertaken by Mr. Luckiesh. J. R. Cravath said a scientific basis for the popularity of the mercury-vapor lamp had now been established. G. C. Keech did not fully agree with the statement that we need light most to detect shades and colors and not so much for acuity. Some experiments are now being made to produce a light having an efficiency of one watt per candlepower and that will give practically true colors. T. H. Aldrich asked many questions, among them whether the low intrinsic brilliancy of mercury-vapor lamps did not add to the visual acuity. M. G. Lloyd declared that Mr. Luckiesh's argument against acuity methods of doing photometric work were very serious. For general illumination requiring correct color values monochromatic light is unsuitable; but for work requiring great detail, such as proof reading, type setting, mechanical drawings, etc., monochromatic light is indicated, both because of the greater acuity attainable and because of the lower intensity required. Mr. Luckiesh closed the discussion by answering numerous questions relative to details of his tests. He did not find eye fatigue to result from acuity work with monochromatic light. He also thought that intrinsic brilliancy has very very little influence on acuity.

The committee appointed to urge consideration of the principles of illuminating engineering in public lighting reported progress in its work. It is endeavoring to have the new flaming-arc Chicago street lamps hung at a height of 30 feet instead of 20 feet as had been proposed.

At the April meeting of the Chicago Section window lighting will be the subject for discussion. Office lighting will be taken up at the May meeting.

Electricity in Stone Quarries and Gravel Pits.

Advantages of Electric Drive—Selection of Motors—Power Equipment—Typical Installations—Data Sheets.

The fact that the majority of stone quarries and gravel pits can be taken on as "off-peak" business is alone of sufficient importance to stimulate central-stations to greater activity in their campaign for this business. If operations are carried on during the winter months the fact that a special low off-peak rate can be secured by remaining off the peak during "lighting" months will influence superintendents to arrange their operations so as to avail themselves of this rate. The large plants, turning out enormous quantities of crushed stone and gravel, usually operate all year, save for occasional shut downs for overhauling, and therefore cannot be classed as off-peak business. However, even where the regular rates based on maximum demand are charged, these plants, although most of them have a high demand, can purchase current from a central station and thereby effect a considerable saving over steam operation. The plants of Dolese & Shepard and the United States Crushed Stone Company, both located near Chicago, are excellent examples of this, both having purchased current for a number of years and made accurate cost comparisons.

With few exceptions, the numerous advantages of electric motor drive that apply in so many industries apply equally as well in the quarry and gravel industry. The efficiency of the electric motor, its rugged construction and its ability to operate under the most severe conditions are particularly desirable characteristics for this service. Also, electric drive minimizes the danger of accidents and delays, and by means of suitably located remote-control switches make it possible to shut down the entire plant in case of emergency. This latter feature is of great importance in stone quarries.

In soliciting the adoption of electric drive for stone quarries and gravel pits a large proportion of success depends upon the attitude of the central-station power solicitor to correctly analyze existing plant-operating expenses and fixed charges. Ability to do this readily and correctly will go far to demonstrate definitely and convincingly to a prospect the flaws and waste and general field for improvement in his power layout.

In the great majority of cases the power solicitor has to contend with a present steam plant and must convince the owner that electric drive with energy purchased from the central station will not only mean a saving but a saving sufficient to permit of scrapping the present steam plant—which course is almost universally necessary.

The steam plant of a stone quarry or gravel pit is, in the vast majority of cases, an exceptionally inefficient one, operating under adverse conditions and

General View of Quarry Showing Two Skip Hoists—United States Crushed Stone Company.

with great losses. The buildings are more or less temporary and in their construction practically no attention is given to such items as economy in handling fuel and ashes, draft for furnaces, steam piping, etc. Machinery is usually of an inexpensive and inefficient character and as a result enormous amounts must continually be spent for repairs and renewals. Trouble is also being encountered with boilers due to muddy water usually found at quarry sites. When these conditions are figured on a basis of dollars and cents, and then compared with the cost of equipping the plant with motors and the operating costs with electric drive it certainly should not be difficult for central stations to secure this business.

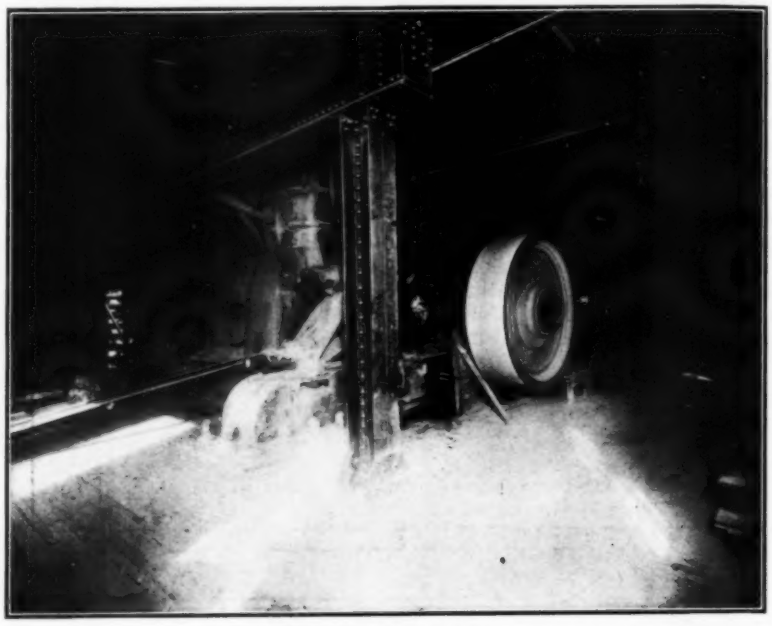
Selection of Motors.

The Public Service Company of Northern Illinois is giving the stone-quarry proposition very careful study and its engineers are working in very close harmony with all of the plants in its territory. The company is enthusiastic in promoting all new styles of machinery which will render more efficient its customers' plants and reduce operating costs in either the investment, labor, or power-consumption items.

Electric drive from the lines of the Public Service Company is proving highly satisfactory to stone quarries in Northern Illinois. The company is offering special "non-peak" rates to all quarries who will agree not to operate their plants between the hours of 4 p. m. and 8 p. m. during the months of November, December, January and February. These rates have proven so satisfactory to existing customers that only within the last few weeks other quarries have abandoned the use of their steam plants and executed five-year contracts with the company for electric power.

The engineers of the Public Service Company, in their work of laying out the motor equipment for quarries, are recommending certain features which, coming from a company of this size and experience, are of interest.

Motors for Crushers. It is recommended that where crushers are driven by individual motors, all such motors be of the slip-ring, or wound-rotor type, from a 15-horsepower motor driving a No. 3 crusher, upwards. Slip-ring motors have a very much stronger starting torque than do the squirrel-cage type of motors and in case crushers are accidentally or intentionally shut down when full of rock it is often possible, by backing the belt up six or eight feet, to start the crusher with a slip-ring motor, without cleaning out all of the rock as it is necessary to do if a squirrel-cage motor is used. This feature will at times save from 15 minutes to two hours' time in the operation of the crusher plant. Along these lines it is recommended that belts to crushers be of the highest grade and amply large so as to stand undue strain or slippage under such extreme starting conditions. It is strongly advised that all motors throughout the plant shall be equipped with dustproof bearings.



Motor-Driven Rolls.

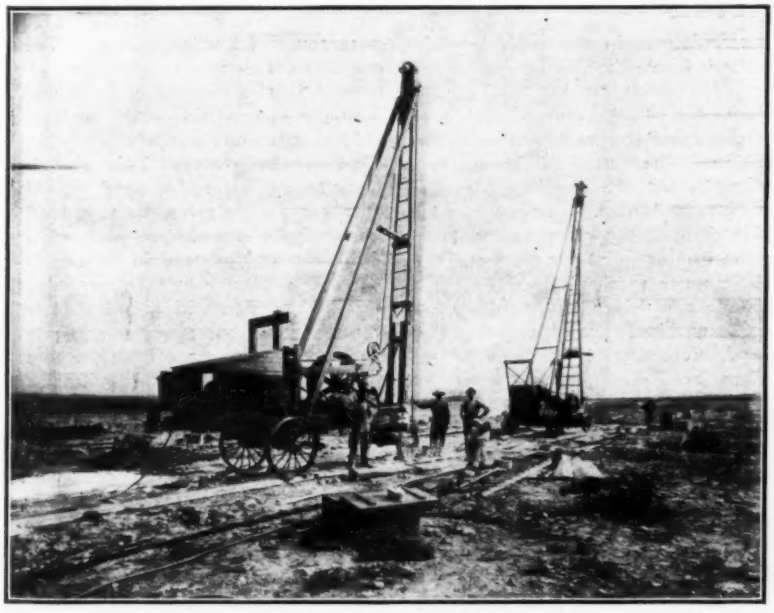
Motor Driving Conveyors.

Motors for Bucket Elevators. As with crushers, these engineers approve of the use of slip-ring motors on bucket elevators, where the elevators are of comparatively large size and driven by individual motors. At times when the elevator boot becomes filled with rock, due to some stoppage of the elevator, it is possible to start same more slowly, with more power and under better control with the multiple-point starting apparatus of the slip-ring motor than with the two-point starting apparatus of the squirrel-cage motor.

Pumping. Centrifugal pumps are being recommended for all quarry purposes, the usual foot valve being placed

on the suction and the check valve being put immediately above the pump in the discharge line to prevent water-hammer damaging the pump. For all quarries of average size, the company's engineers are recommending centrifugal pumps of about 400-gallons-per-minute capacity; the reason for adopting this size is that one pump of this size seems to take care of the average seepage into this size of quarry and under none of the local conditions does this size pump require more than a 30-horsepower motor. The Public Service Company's rules require that all motors of 35-horsepower or more to be attached to its lines shall be of the slip-ring type and the engineers appreciate that it is desirable in a great many cases to have the starting and stopping of the pump control from a point considerably distant from the pump and that such control is far more easily effected with a squirrel-cage motor driving the pump than with a slip-ring motor. If a pumpage of more than 400 gallons per minute is desired from a quarry it is often desirable to pump at more than one point as the installation of two units causes a more flexible and efficient system. These engineers strongly recommend that all motors used for driving quarry pumps shall have impregnated windings so as to render the windings more impervious to moisture than are the winds of standard motors.

Substation.



Two Motor-Driven Well Drills.

Drills. Compressed air is perhaps one of the largest individual items of power cost around a quarry and every effort is being made to cut down the necessary amount of compressed air. Where possible the use of small portable compressor outfits located out in the quarry is recommended. This practice eliminates long lines of piping with the attendant leaks and losses.

The use of deep-well electric-drilling outfits for blast-hole purposes has been making rapid strides for the last three years and it is generally conceded that they effect great economy in power, labor and dynamite. One of the biggest savings incident to the use of these outfits is the fact that comparatively few blasts are necessary and it is consequently not necessary to tear up and re-lay stone-car tracks as often as it is when all drilling is done with standard tripod drills.

Another form of drilling is also becoming popular on account of the general tendency of the stone quarries to adopt central-station service and the higher power efficiency of the new method of drilling. The new method in question is the adoption of "pulsator" drills as manufactured by the Ingersoll-Rand Company. The standard tripod drill requires about 100 cubic feet of air per minute when operated by compressed air, which requires about 30 horsepower at the air compressor. In all probability there is, in the average quarry, a leakage from the air mains of at least 30 per cent of the total quantity of air compressed. This leakage is a constant factor and will bring the power charge against each air drill up to 30 horsepower intermittent load, plus 10 horsepower constant load over the ten-hour day. The pulsator drills are equipped with 7.5-horsepower motors, it requiring something over five horsepower to start the drills and about four horsepower running load while they are in operation; also, there is no loss of power when they are shut down.

Power Requirements.

The following data relative to power requirements of the various machines use in stone quarries may be of value to central-station engineers figuring on quarry installations.

GATES GYRATORY CRUSHER.

No.	H. P. Required.
4	14- 21
5	22- 30
6	28- 45
7½	50- 75
8	70-110
9	100-150

AUSTIN GYRATORY CRUSHER.

No.	H. P. Required.
0	4- 5
1	8- 10
2	12- 15
3	20- 25
4	25- 30
5	30- 50
6	40- 60
7½	75-125
8	100-150

AUSTIN JAW CRUSHER.

No.	H. P. Required.
2½	10
3	12
4	18

BLAKE ROCK CRUSHER.

Jaw Opening.	H. P. Required.
10 by 4	4
15 by 9	10
24 by 12	20
30 by 24	65

STEEL ROCK BREAKERS.

Jaw Opening.	H. P. Required.
7.5 by 13	12
9 by 15	15
10.5 by 22	20-25
11 by 26	25

WILLIAMS CRUSHER.

1	30
2	40
3	60
4	80
5	100
6	150
8	300

SYMONS CRUSHER.

No.	H. P. Required.
6	18-25
5	22-30
7½	50-75
9	100-150

McCULLY CRUSHER.

No.	H. P. Required.
1	4- 6
2	6- 10
3	10- 15
4	12- 20
5	20- 25
6	25- 40
7½	45- 70
8	65-100
9	100-140
10	125-175
12	200-250

Electric power shovels have been used in a number of stone quarries and at present several manufacturers are working on new designs.

ELECTRIC POWER SHOVELS.

Weight of Shovels— Tons.	Size of Dipper, Cu. Yds.	H. P. Required. Hoist.	Thrust.	Swing.
30	1	50	30	30
35	1.25	50	30	30
35	1.25	60	30	30
35	1.25	75	35	35
42	1.52	75	30	30
65	2	100	35	35
95	3.33	150	50	50
100	4	200	80	80

Typical Installations.

The quarry of the A. C. O'Laughlin Stone Company, at Belvidere, Ill., may be considered a typical average-size plant. This company was the first in the Chicago territory to adopt electric drive throughout, having had same in operation now for over four years. The company was not only a pioneer in the use of electric power, but was also among the first to make use of deep-well drilling machines for drilling blast holes, making same electrically driven and replacing several air-driven tripod drills.

The nominal capacity of this plant is 1,000 yards of crushed rock per day but with the electric drive it can, when necessary, increase this output by 25 per cent. The company keeps very close records of its costs, the general office having general reports from the quarry of rock output and electrical consumption which are checked against each other and the quarry has to answer promptly for any unusual procedure in the day's operation, which is very quickly shown by the relation of the rock output to the total consumption of power. The kilowatt-hour consumption of electric power at this plant averages about 1.75 per cubic yard of rock output, this figure including electric power necessary for deep-well drilling outfits, hoisting equipment for bringing cars out of quarry (quarry being about 100 feet deep), all crushing and screening processes, and operating centrifugal pumps which pump about 400 gallons per minute out of the quarry for from 10 to 20 hours per day.

One of the large electrically equipped stone quarries in the Chicago territory and one which is of exceptional interest is that of Dolese & Shepard, located near Gary, Ill. The company owns at the site a tract of land covering about 350 acres, 135 acres of which are available for quarrying purposes.

The output of this plant varies in size from particles which go through a screen with 100 meshes to the square inch to stones four inches in size. The former are used as a substitute for stone and the latter shipped directly to the steel works in the vicinity for use as flux in blast furnaces.

The crushing plant includes seven main buildings located in a row. The quarry from which the stone is mined is located directly north of the plant. Starting at this point the first building in the row is the substation. The other buildings in the order in which they are located are designated as follows: Receiving crusher building; No. 9 and No. 6 buildings; the main screening building and the re-crushing building. The output of the quarry is delivered to the receiving crusher building, and then is passed continuously through the remaining buildings to the loading point for shipment.

The entire mechanical equipment of this plant is driven by electricity. All large machines are driven by individual motors, and the smaller machines are group-driven from line shafts belted to motors.

Power is purchased from the Public Service Company of Northern Illinois. In addition to the feeder from this company, there is also a circuit connecting the plant with the Fisk Street station of the Commonwealth Edison Company of Chicago, so that in the event of a breakdown on the former line, which comes from Joliet, power may be received from Chicago. Sixty-cycle, three-phase energy is received at a pressure of 33,000 volts at the substation of the plant and is passed through two 750-kilowatt step-down transformers, which reduce the pressure to 440 volts for local distribution.

Energy is delivered from the substation to the different buildings by means of three-conductor, lead-covered cables placed in vitrified ducts laid underground the full length of the plant. Manholes are placed at each section of the latter so that branch connections may be made to distributing cabinets within the building. From these cabinets a separate supply feeder delivers power to each motor.

The plant is lighted throughout by arc and incandescent lamps, the current for lighting being stepped down by transformers in each building from 440 to 120 volts. Arc lamps are provided about the grounds and in the quarry, in order that operations may be carried on at night. These lamps are supplied with current direct from the substation and are entirely separate from the lighting circuits.

The first process in the operation of the plant is to loosen the stone around the quarry. This is accomplished by drilling holes in the rock by means of automatic-feed Ingersoll-Rand rock drills mounted on rectangular frames, and arranged to be moved as a unit. The drills are operated by compressed-air motors mounted on the frame. The air is furnished by two two-stage Ingersoll-Rand compressors installed in the substation. These two compressors each have a capacity of 2,200 cubic feet of free air per minute delivered at a pressure of 80 pounds. Each compressor is belted to a 300-horsepower induction motor. These compressors deliver to a receiver tank located in the substation, from which a supply pipe is laid on the surface in a loop extending entirely around the edge of the quarry. This pipe line is arranged in sections and provided with necessary valves, so that branch lines may be extended to points where drilling operations are in progress.

Stone loosened by the process of drilling and dynamiting is loaded into cars by steam-operated power shovels.

For conveying stone from the quarry to the receiving crusher building an electric traction system is installed, operated on the Woodford system of central control, which is one of the most important and interesting features of the entire installation. This is an industrial haulage system, consisting of electrically driven cars operated from an ordinary track and controlled from a central point.

At the plant of the Dolese & Shepard Company a double track of standard gauge is laid on the quarry bed, extending around its entire periphery and having cross-over tracks at inter-

(Continued on page 605)

Stone-Quarry and Gravel-Pit Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

United States Crushed Stone Company, McCook, Ill. Crushed stone and cement. Group and individual drive. Running hours per week varies with season.

Total connected horsepower, 2,189; total number of motors installed, 26; average kilowatt-hour consumption per month, 98,433.

Load-factor, 8.2 per cent.

Kilowatt-hour consumption per month for 12 months: February, 86,300; March, 123,000; April, 101,700; May, 119,900; June, 134,400; July, 110,200; August, 112,100; September, 120,000; October, 127,100; November, 86,100; December, 14,200; January, 16,200.

The average electrical energy consumption per cubic yard of output is 1.66 kilowatt-hours.

Motor Installation

The following is a list of the motors installed, with their respective drives. All motors are polyphase induction machines operating at 440 volts.

No.	Horsepower	Speed R.P.M.	Application
2	10	1,200	Slip-ring motors operating two well drills.
1	150	600	Belted to two-stage Ingersoll-Rand air compressor.
1	200	600	Belted to No. 8 plant.
1	10	600	Belted to No. 12 skip-tower feed rolls. This motor is controlled by a remote-control compensator.
1	30	900	Squirrel-cage motor driving No. 14 primary screen.
1	40	900	Slip-ring motor driving No. 6 crusher.
1	20	900	Slip-ring motor driving No. 4 crusher.
1	85	720	Belted to No. 9 conveyor and screens.
1	15	600	Belted to No. 20 pan conveyor.
1	10	600	Belted to No. 11 skip-tower feed rolls. This motor is controlled by a remote-control compensator.
1	30	900	Belted to No. 13 primary screen.
1	40	900	Slip-ring motor driving No. 6 crusher.
1	20	900	Slip-ring motor driving No. 4 crusher.
1	300	600	Slip-ring motor driving No. 10 skip hoist.
1	300	600	Slip-ring motor driving No. 7 quarry hoist.
1	15	720	Driving No. 3 upper feed roll.
1	15	720	Driving No. 4 tower feed roll.
1	2	1,300	Direct-connected to No. 6 oil pump.
1	52	720	Driving No. 9 auxiliary hoist.
1	200	514	Driving No. 2 plain roll.
1	250	514	Driving No. 1 slugger roll.
1	300	600	Driving No. 8 quarry hoist.
1	75	600	Driving centrifugal pump.
1	25	1,200	Direct-conneced to four-inch three-stage fire pump.

Energy for this installation is supplied by the Sanitary District of Chicago.

Fort Smith Stone Quarry, Fort Smith, Ark. Crushed stone. Combination drive. Running hours per week, 60.

Total connected horsepower, 100; total number of motors installed, 3; average kilowatt-hours per month, 3,785; average kilowatt-hours per month per connected horsepower, 38.

Load-factor, 8 per cent; operating-time load-factor, 14.5 per cent.

Kilowatt-hours per month for 11 months: January, 1,200; February, 1,560; March, 2,040; April, 3,800; May, 5,480; June, 5,360; July, 4,760; August, 5,400; September 6,080; October, 3,680; November, 2,280.

Motor Installation

The following is the motor installation at this plant. The supply source is two-phase, 60 cycles, 220 volts.

No.	Horsepower	Speed R.P.M.	Application
1	50	900	Belted to a line shaft driving one Allis-Chalmers No. 4 gyratory crusher; one 60-foot bucket conveyor; one four-section four-foot screen; and one elevated link-chain tramway.
1	25	900	Belted direct to Allis-Chalmers No. 2 gyratory crusher.
1	25	900	Belted direct to six-inch centrifugal pump.

Energy is supplied by the Fort Smith Light & Traction Company.

Stone-Quarry and Gravel-Pit Data—Sheet No. 2.

Stone Crusher Plant, located in Pennsylvania. Name withheld by request. Group and individual drive. Running hours per week, 60.

Total connected horsepower, 217; number of motors installed, 5; average kilowatt-hours per month, 3,371. Load-factor, 3 per cent; operating-time load-factor, 6 per cent.

Kilowatt-hour consumption per month for 8 months: October, 5,540; November, 4,950; December, 1,290; March, 3,590; April, 4,250; May, 2,620; June, 2,670; July, 2,060.

The energy consumption per ton of rock crushed is 0.34 kilowatt-hour.

MOTOR INSTALLATION

The following is a list of the motors installed, with their respective drives. The supply source is two-phase, 60 cycles, 220 volts, and 600 volts direct current.

No.	Horsepower	Speed R.P.M.	Application
1	75	850	Squirrel-cage motor belted to a No. 6 Gates, style "K" stone crusher.
1	100	850	Squirrel-cage motor belted to a 12.25-inch by 18.25-inch by 12-inch stroke, Ingersoll-Rand air compressor, running at 180 revolutions per minute and supplying air at 90 pounds pressure to the drills.
1	10	690	Belted to a 10-foot two-hanger line shaft driving one 12-foot by 3-foot revolving screen, running at 19 revolutions per minute and one 16-inch by 10-inch by 8-inch bucket elevator, 50 feet high.
2	16	...	Series-wound motors operating a 10-ton Baldwin-Westinghouse locomotive used to haul five empty cars weighing one ton each up a two-mile five-per-cent grade.

Butler Brothers, Randolph, Minn. Gravel. Individual drive. Running hours per week, 60.

Total connected horsepower, 300; total number of motors installed, 6; average kilowatt-hours per month, 19,450; average kilowatt-hours per month per connected horsepower, 64.

Load-factor, 14 per cent; operating-time load-factor, 25 per cent.

Kilowatt-hour consumption per month for four months: July ,20,500; August, 19,300; September, 22,500; October, 15,500.

MOTOR INSTALLATION

The following is a list of the motors installed, with their respective drives. All motors are three-phase, 60-cycle, 220-volt machines.

No.	Horsepower	Application
1	75	Belted to belt conveyor.
1	20	Belted to belt conveyor.
1	25	Belted to belt conveyor.
1	100	Direct-connected to one seven-inch rotary pump with 12-inch suction; used for pumping water from pits.
1	75	Belted to No. 3 gravel crusher made by Austin Manufacturing Company.
1	5	Belted to line shaft driving one drill press; one 12-inch lathe, one emery wheel and one hack saw.

Energy for this installation is supplied by the Consumers Power Company.

Stone Crushing plant. Name withheld. This plant quarries and crushes stone of two kinds, a soft grade of cement rock, and buckwheat stone containing considerable lime. The quarrying is done mostly by hand. Horse cars are employed to convey stone from the quarry to the crushers. There are 40 men employed, working 10 hours per day. Group drive.

The maximum capacity of this plant is 6,000 tons per month; average output, 4,000 tons.

Total connected horsepower, 67.5; total number of motors installed, 4; average kilowatt-hours per month, 3,311.

Load-factor, 7.7 per cent; operating-time load-factor, 28.8 per cent.

The electrical energy consumption per ton of stone crushed is 0.75 kilowatt-hours.

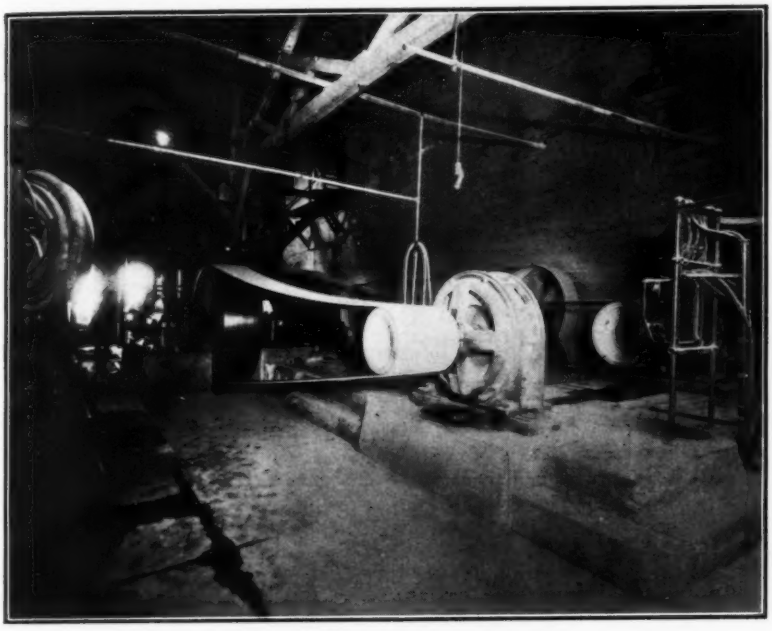
Kilowatt-hours for 10 months: April, 1,020; May, 3,120; June, 4,380; July, 3,690; August, 5,370; September, 3,420; October, 3,930; November, 5,010; December, 660; January, 2,520.

MOTOR INSTALLATION

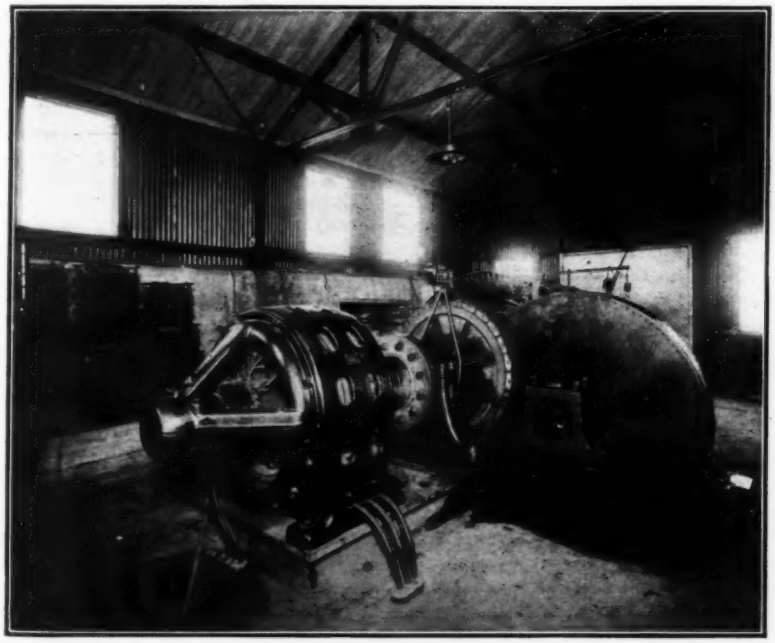
The following is a list of the motors installed at this plant with their respective drives. All motors are of the squirrel-cage induction type.

No.	Horsepower	Speed R.P.M.	Application
1	40	1,140	Belted to a Power & Mining Machinery Company No. 4 McCully gyratory crusher, capacity 20 to 40 tons per hour. Pulley 28 by 12 inches. From driving shaft of above machine a belt runs to a drum mechanism which draws a 700-pound car up a 100-foot incline, five-per-cent grade. Maximum load of car, 2,400 pounds; average load, 1,200 pounds.
1	15	1,120	Belted to a three-hanger shaft and a two-hanger countershaft, latter bevel-geared to lower end of a revolving screen, 15 feet long by 2 feet 4 inches diameter. Revolves at 32 revolutions per minute. Geared from above three-hanger shaft is a 12-inch bucket elevator, 65-foot lift.
1	5	1,130	Belted to a short shaft driving a 20-inch horizontal belt conveyor about 35 feet long. Belt designed to move in either direction.
1	7.5	1,140	Belted to a two-hanger shaft then geared to driving shaft at top of a 14-inch belt conveyor, having a 30-degree rise for 75 feet.

vals. The inner track, or that farthest from the sides of the quarry, is considered the main track, and the other the loading track. At the end of the quarry nearest the crushing plant a track leading off from the main one leaves the lower level and extends up a six-per-cent grade to the surface, where it turns to the right on a three-per-cent grade and extends further up a six-per-cent grade and on a steel trestle to the crushing plant. The total elevation above the lower level of the present quarry is about 80 feet. On its approach to the crushing plant the track divides, a branch running on each side of the crusher and uniting again into one track on the opposite side of the plant, extending down an eight-per-cent grade, curving to the right and connecting with the main track at the lower level. The track on the incline to the crusher and back forms half of a figure eight, the other half being completed by a track on the lower level, the one on the six-per-cent grade crossing that on the eight-per-cent grade, making the entire track circuit free for a continuous cycle of operations.



Motor-Driven Air Compressor.



Motor-Driven Skip Hoist.

The cars of this system for handling the stone are of the side-dump type, of ten-yards capacity each, built entirely of steel, except the box, which is steel-lined. Each car is equipped with 30-horsepower street-railway motors and also with an automatic controlling mechanism for this system of control. Each car is also equipped with an electric brake under the control of the central operator. Included in the automatic controlling mechanism on the cars is a selective relay; which, upon the forward movement of the controlling lever in the tower, places itself in such a position as to close the motor circuit. Upon the opposite movement of the lever this relay closes the brake circuit, causing the brakes to operate.

Electric current is conducted to the motors and controlling mechanism by means of a third rail, divided into sections, which is mounted between the track rails. This location of the third rail is particularly adapted for tracks which are necessarily portable.

The controlling tower from which all of the cars in the system are manipulated is located near the crusher and in sight of a large portion of the quarry bed, where the circuit of main and loading tracks is located. From this tower each car may be operated independently from any of the others. It is possible to start it in either direction or to stop it with a brake upon any portion of the system of tracks over which it is being operated. The switches of the cross-over tracks are operated from the controlling tower, so that the operator may dispose of the car on either the main track or the loading track at will.

After the car is loaded it is unnecessary for the operator to pay any attention to it on its trip out of the quarry, up the grade, and to that portion of the track approaching the crusher, as it here runs on a level track through the building and stops without his attention.

The section of the track in the crusher building is under the control of the operator stationed in the latter. When a load is needed at the crusher it is brought forward by this operator, electrically dumped and started on the downward trip.

The speed of each car on this downward trip from the crusher to the quarry is governed automatically. As each car approaches the downward grade it comes in contact with a stationary trip which automatically oper-

ates a lever extending out from the side of the car. This lever operates a switch which changes the connection, causing the motor to operate as a generator. The current thus generated passes through a resistance mounted on the car, which limits the speed. It may be seen that this speed can either be increased or decreased, according to the amount of resistance inserted.

The level portion of the track leading to the crusher and which divides into two branches extending on each side of it, has a capacity for a number of loaded cars. As these loads may be kept close together, and with the opportunity to dump them on each side of the crusher, it will be seen that the amount of raw material that can be delivered to the crusher is limited only by the number of cars in operation and the facilities for loading them.

The control of the cars is resolved into starting them from the shovels, and bringing them forward at the crusher to be dumped, and starting them upon their downward trip. While in an emergency the car may be started or stopped upon any portion of the track, the operation of each car is continuous and does not require the attention of the operator except at the terminals. A car loaded at any of the shovels will be 1,000 feet or more on its way by the time the next car is loaded at the same shovel, making it possible for empty cars and loaded cars to be operated along the main track and distributed to and from the different shovels as they are needed.

An automatic scale is installed along the route of the loaded car track which weighs each load as it passes over. Each car, by a non-interfering signaling device, indicates at the scale by which shovel the car being weighed was loaded. The weight of the load and the number of the shovel loading it is automatically marked on the tape at the same time. The tonnage of each shovel for the day may in this way be recorded at the scale.

Direct current at a pressure of 250 volts for the operation of the car and track system is furnished by two 200-kilowatt motor-generator sets.

The receiving crusher to which the quarry cars deliver in the first building is of the McCully gyratory type with receiving openings 42 inches in width. This crusher is called the "Mammoth," as it is believed to be the largest of any type that has been built to date and breaks the stone to a size of eight inches and under. Its approximate weight is 213 tons, and it has an estimated capacity of 800 cubic yards of stone per hour. For operating, it is connected by means of a steel rope drive to a 250-horsepower induction motor.

This crusher has two discharge openings, one on each side, which deliver stone into pan conveyors 54 inches wide. These conveyors extend up into the top of the No. 9 crusher building at an angle of 45 degrees. Each conveyor is driven at the upper end through gearing by means of a 75-horsepower induction motor.

These conveyors both discharge at the top into two No. 9 gyratory crushers, which are each belt-driven by an individual 100-horsepower induction motor. The stone is reduced in these crushers to pieces having a maximum size of four inches, and is discharged through each crusher into two 48-inch by 24-foot revolving screens, having two-and-one-half-inch perforations. The stone passing each of these four screens drops into a hopper supplying a 24-inch horizontal belt conveyor. These four conveyors are placed in concrete-lined trenches and extend from this building to and through the adjoining No. 6 crusher building, where they discharge the stone at the bases of four 30-inch belt conveyors leading to the main screening plant. The oversize from each of the screens to which the output of the No. 9 crushers also is delivered falls into a 48-inch pan conveyor similar to the one in the receiving crusher building, which elevates the stone from these screens at an angle of 45 degrees and discharges it into storage bins of the No. 6 crusher building.

In buildings on each side of these bins there are installed four No. 6 gyratory crushers, which reduce this stone to about three inches in size and discharge it into 24-inch belt conveyors that extend from the No. 9 building to the 30-inch conveyors leading to the main screening plant. These crushers are operated by 50-horsepower induction motors.

Four 30-inch belt conveyors geared to 60-horsepower induction motors convey stone to the main screening building, where it is discharged in the revolving screens. The stone is here distributed, according to size, to the main storage bins.

The re-crushing plant is equipped to reduce the size of any stone, suitable conveyors and crushers being provided. All the crushers and conveying machinery are driven by individual motors. The average electrical energy consumption per cubic yard of stone produced, at this plant, is 1.2 kilowatt-hours.

Another interesting installation is that at the quarry of the United States Crushed Stone Company, located at McCook, Ill. This plant is operated night and day and turns out an average of 6,000 tons of crushed stone per 24 hours. Electrical energy is purchased from the Sanitary District of Chicago. Sixty-cycle, three-phase energy at a pressure of 12,000 volts is received at the quarry substation and stepped down to 440 volts for power and 120 volts for arc and incandescent lighting.

An interesting feature of the electrical installation at this plant is the application of motor-driven drills. The company has installed two of these, known as blast-hole drills, which have given such satisfaction that additional ones have been ordered to entirely replace the air drills. A view of two of these drills is shown in one of the accompany illustrations. The drill consists of a 10-horsepower motor belt-connected to a shaft operating a walking beam, which alternately raises and lowers the bit of the drill. The drill bores a hole six inches in diameter and 50 feet deep.

It is stated by the officials of the United States Crushed Stone Company that three of these drills are equal to ten of the compressed air type in the matter of work and cost about one-seventh as much to operate.

At this plant stone from the quarry is hauled to the crusher house in skip cars propelled by steam locomotives. When the cars arrive at the foot of the incline leading to the receiving crusher they are hoisted by means of a 300-horsepower skip hoist. After the stone has passed through the rolls and been crushed it drops into a lower hopper and from there is loaded on a retarding roll and into two skip cars of 15-tons capacity each. These cars are run up a steel skipway 210 feet long and built on an incline of 45 degrees. The electric hoist which handles these cars is also of 300-horsepower capacit. A detailed description of the motor equipment is given in the accompanying data sheets.

Cooking Exhibition in London.

In the Electrical Section of the Coal Smoke Abatement Exhibition, which runs from March 23 to April 4, at the Agricultural Hall, London, there is a special exhibit arranged by the electric supply authorities of the British Electrical and Allied Manufacturers' Association to show the advantages of electricity in all its branches, especially heating and cooking. A considerable part of the exhibition is taken up by an electric restaurant, which is in charge of the London Home Delicacies Association, and the cooks operate the kitchen in full view of the visitors.

Wireless communication is to be maintained with Dr. Mawson's expedition to the South Pole by means of intermediate stations between the exploring party and Hobart.

Commercial Practice
Management, Rates, New Business

Selling Electrical Energy for Irrigation Service.

A résumé of an unusually successful booklet in which the weak points of the small gasoline and oil engine and the superiority and economy of electricity are handled in non-technical language. By the aid of the arguments summarized, electric irrigation is displacing all competitors in the territory served by this company.

One of the most important problems before the central-station industry today is the extension of electric-motor service into fields where competing methods of machine driving tend to deter the prospective consumer from adopting the most economical and effective means of operation. The competition of the steam engine is still a serious factor in the general industrial field, and in applications more or less remote from economical steam installations, the yearly sale of great numbers of small gasoline and oil engines challenges the advocates of electricity to the most vigorous effort.

In meeting the competition of small prime movers, the central-station man must have at hand a mass of hard-hitting and convincing arguments based upon experience. So far as possible he must be prepared to work out the cost of a given service, and must have at his tongue's end, in non-technical language, the vital points and data which will turn the scales in his favor. Different industries require treatments, but in general, the advantages of the electric motor in one sphere apply to it elsewhere, and there are often valuable data and material from the standpoint of practical application in a well assembled group of arguments produced on behalf of a specific industry. This is the case in the following notes from a power booklet used on the commercial firing line by district agents, the points being utilized in connection with the sale of electric power for varied service, but primarily for irrigation pumping. To accomplish the dual result of helping the district agent in his soliciting work and to offer the prospect something tangible as a result of an inquiry or discussion of the benefits of motor service, the company recently prepared a pamphlet of 47 pages in which much valuable information is printed concerning the use of elctricity in the territory as a whole. At the top of each page is a succinct, pithy sentence setting forth the benefits of electric power, typical headings being as follows: "Water is wealth and electricity develops water"; "Motors are cheaper than gas engines and much more durable"; "Great saving in the items of fuel, labor and repairs"; "Why a big irrigating company discarded the use of gasoline"; "No more gasoline engines where electricity has been tried"; "Electric power does not fluctuate in cost like gasoline"; "Not one cent paid for repairs on motor in four years"; "Reliability of electricity is safeguard against shut-downs"; "Ask these people why they abandoned their gas engines"; "One company is pumping fourteen plants by electricity"; "Electric motors are recommended by all practical ranch-men"; "Some epitaphs of the gas and the steam engines"; "A page of gas-engine displacements by electricity"; "Six motors have been installed and more are wanted."

A feature of the pamphlet is a short series of introductory argument on behalf of electricity, which, with their headings, are given below.

Original Cost.

Motors are considerably cheaper than gas engines. Prices may be obtained from the nearest district agent of the company.

Durability of Engines.

Statistics state that the average life of a gasoline engine is seven years. Cylinders of engines will probably need reboring once in three years if used to any extent. They can only be rebored twice, after which a new cylinder or engine must be purchased. Owing to the reciprocating motion the iron and steel in engines are subject to rapid crystallization and hence liability of breakage. The vibration of engines being great, parts are liable to break and cause heavy damage and delay. Lubricating is difficult, owing to the great area of the cylinder and pistons. If a space 2 inches square runs without lubricating oil for a few minutes great damage may be done. The circulating pumps or belts often break, causing overheating. The heavy bearings must be perfect and are subject to great wear on account of the weight. Distillate contains many impurities. Sand, carbon, asphaltum, etc., in the distillate cut cylinder and piston. Rust accumulates very rapidly when an engine is not in use.

Durability of Motor.

This has not been properly ascertained, as the first motors made are still in operation. However, owing to the following reasons, the life of a motor should be of a very long duration: there is no jar or reciprocating motion; no vibration; only two bearings, perfectly housed and lubricated by large oil wells by means of brass rings; there is nothing to adjust; oiling is only necessary once a year; shafts are made extra heavy; bearings (only two) are self-alining; the motors being light, bearings are subject to very little pressure; bearings should last at least ten years; new ones are readily and cheaply installed; oil wells are closed by tight-fitting covers, thus preventing entrance of dust or dirt; fuses are installed which prevent serious overloading, and automatic cut-outs are provided which absolutely prevent a motor from burning out.

Cost of Fuel.

Do you know what your power costs you? Probably not, if you use a gas or steam engine. Distillate has sold from 4.5 to 11 cents per gallon during the past five years. The average price is now about 10 cents. You cannot make a contract for more than a year. Evaporation is heavy and leakage may be. You may get as many gallons as you pay for and may not. The quality is bound to vary. Perhaps the oil man will be out when you want it. The price of electricity is standard and it is always on the wire ready for your use. Can you think of any commodity except electricity which has grown cheaper within the past ten years? You can obtain a long-term contract for electricity and know what it will cost you for years to come.

Repairs.

Engine repairs must be expensive. Experts are required and experts are expensive. If a part breaks you may have to wait for it from the East, and when it comes it may not fit. Meanwhile, how about your alfalfa or orange trees? You must figure wear and tear on engine plus wear and tear on your-

self. Can you afford it? The repairs on a motor are bound to be very trivial, and a telephone call will bring an expert at once. You see the electric company is interested as well as yourself; if your motor does not run, the "juice" bill stops. In cases of emergency, the company has hundreds of motors operating in your district, and if they do not have one in the warehouse can easily borrow one and install it in a few hours. It is almost impossible for a motor to be out of order. If the current fails on the line, the company is more interested than anyone else in getting it on again, as no revenue is obtained from dead lines.

Engineer.

Few men are competent to run engines. However, if you hire, they are expensive, may be sick or quit when you need them most, and in case they are discharged may be revengeful. Any child can be taught to start a motor in ten minutes. When started, it needs no attention. One man employed by the Blank Coal Company operates 17 motors day and night. The motors are situated from 100 yards to one mile apart.

Lubrication Oil.

Fifty cents worth will last a motor a year. Gas engines use great quantities of oil, ignition batteries and waste.

Noise.

Engines are noisy. On still nights they may jar the nerves of your neighbors for miles around. If used with a muffler, they are inefficient. Does not an automobile develop more power for the same gasoline when the muffler is open? Motors are absolutely noiseless.

Dirt and Odor.

Engines are dirty and disagreeable to work with.

Efficiency.

Engines are inefficient on variable loads. If too small, they will not run. If too large, they use a great deal more oil than is necessary. Motors are guaranteed to carry 25-per-cent overload continuously, and will carry a greater overload temporarily.

Reliability.

Some engines are not very reliable. Too many things to adjust and get out of order. They may run today, but not tomorrow, on account of a change in the atmosphere, shrinking, or expansion of the steel of some delicate part. Motors are always ready at a minute's notice, day or night.

Insurance.

High on engines, low on motors.

Starting.

It is hard to turn the heavy flywheel to start the engine. If it will not start readily the labor is harder every time you turn it and your temper does not improve in proportion to the labor done. Maybe you are in a hurry. With a motor, throw the switch and the motor starts instantly.

Power is Steady.

Centrifugal pumps depend very largely on steady power for best operation. Gas engines vary the speed of the pump, and hence diminish the flow of water.

Space.

Motors are small and compact. They can be put on a wall or ceiling. Engines are heavy and cumbersome.

Cost of Operation.

Gas engines, when new, operate on about one-seventh gallon of distillate per hour for each horsepower. With distillate selling at 10 cents per gallon, the cost would be 1.4 cents per horsepower-hour. As the engine grows older, more distillate is required. Assuming that a 50-horsepower gas engine will be operated 1,200 hours per year, an estimate of the cost follows:

Distillate	$ 877.10
10-per-cent depreciation on engine costing $2,000	200.00
Engineer, six months at $70	420.00
Lubricating oil	30.00
Batteries	15.00
Repairs	75.00
Gasoline for starting	6.00
Total cost of engine service	$1,623.10

The cost of a 50-horepower motor running the same time would be:

Electric power at two cents per kilowatt-hour	$ 900.00
Two-per-cent depreciation on motor and transformers	20.00
Attendance, six months at $20	120.00
Lubricating oil	1.00
Total cost of motor service	$1,041.00

The balance of the company's booklet covers the presentation of a large number of testimonials from users of electric power in the territory served, instructions on reading meters, and directions on measuring water. It has been found most helpful to include the last feature, as a prospective purchaser who becomes interested in the possibilities of electric service must remain interested if his business is to be secured, and the company contends that there should be no chance of delay through inability to estimate the fundamental hydraulic problems. The following brief but effective paragraph deals with the elements of water measurement.

How to Measure Water.

In order to determine the quantity of water discharged by a pump, the common method is that of letting the water pass over a weir. The following conditions should be observed in the construction of the weir: the depth of water passing over the edge must be not over one-third the depth of the flume or canal, and the distance from the side of the canal to the side of the opening must not be less than the depth of the water over the crest. The edge over which the water falls must be level and sharp, and care must be taken that the overfall below the weir is not less than twice the depth. The head on the weir should be measured far enough back so that the height is accurately indicated and baffle plates should be provided so as to eliminate as much as possible of the excess velocity of approach.

One cubic foot per second equals 450 gallons per minute, and is almost equivalent to 40 California miners' inches. One cubic foot of water equals 7.481 United States gallons, and weighs 62.4 pounds. To estimate the horsepower necessary to elevate water to a given height, multiply the total weight of water in pounds discharged per minute by the head in feet and divide by 33,000. This is the theoretical horsepower, and should be doubled to allow for inefficiency of pump, belting, etc. If it be desired to calculate the power required directly from the number of miners' inches, multiply the latter by the head in feet and by 0.00567.

Electric-Vehicle Campaign in Minneapolis.

An added impetus has been given the electric-vehicle situation in Minneapolis, Minn., by the establishment of an electric-vehicle department by the Minneapolis General Electric Company. A battery and vehicle engineer will be employed to give expert advice and assistance to vehicle owners and instructions will be given in the care and operation of batteries and vehicles.

The electric company has already placed in service a fleet of electric vehicles for its own use and detailed records are kept of performances and cost. With this information at hand and with the assistance of the newly created department, it is confidently expected that the number of electric vehicles in Minneapolis will be greatly increased.

Central-Station Supply for Summer.

The C. Lee Cook Manufacturing Company, of Louisville, Ky., which has been operating its plant with electricity for some time, has decided to disconnect its engine and boiler during warm weather and to use central-station current. It has contracted for the installation of a 24-kilowatt motor-generator set, which will be put in at once. The company will make its own power in the winter, as it requires steam for heating purposes.

Electrical Construction

NOTES ON ELECTRICAL CONSTRUCTION.

By George J. Kirchgasser.

This is the twelfth of a series of articles on electrical construction. The matter is treated in a thoroughly practical manner, and will cover every phase of construction usually encountered by the electrical contractor or the electrician in an industrial plant. This article discusses in detail the wiring of alternating-current motors.

Alternating-Current Motors.

Single-phase induction motors of the commutator self-starting type are now used to a very considerable extent in small units of one-quarter, one-half and up to 15 horsepower. The single-phase motor illustrated in Fig. 4 is rated at 20 horsepower. The distribution of alternating current has led to the increased use of these motors on lighting lines. The installation is simple and no starting apparatus is necessary with the small sizes. For motors of above one horsepower or where the starting requires a heavy current, starting devices should be provided. Fig. 3 illustrates a standard type of manually operated starting device for the commutator type of self-starting single-phase motor. The manually operated starter is similar in appearance to the direct-current starting rheostat, but the construction is somewhat different. The

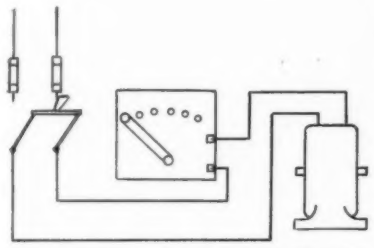


Fig. 1.—Connections for Starting Resistance of Single-Phase Motor.

Fig. 2.—Induction Motor of the Wound-Rotor Type.

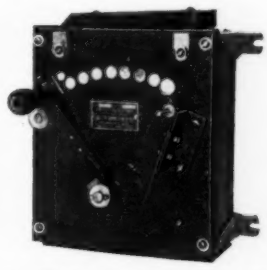


Fig. 3.—Manually Operated Starting Device.

resistance used is arranged so as not to be affected by the inductive alternating currents. It is not always necessary to have the starter provided with a no-voltage release. A latch is provided, in most cases, which holds the lever of the starter in the running position with all the resistance short-circuited. In case the current supply to the motor is temporarily interrupted the lever remains in this position—does not snap back and when the current returns, the motor will have the full line voltage impressed on it. This will, with the motor in general use, cause a heavy pull of current but will not injure the motor. It may, however, cause disturbance to the voltage regulation of the line, blow fuses or may even start the motor too suddenly; where these conditions are objectionable the automatic no-voltage release should be substituted for the latch, so that the starting lever will automatically return to the starting position when the current is "off." Single-phase motors operating pumps and the like can be easily started and stopped by automatic starters and controlled from remote points if desired.

The single-phase motors in greatest use at present have a commutator to which the windings of the armature, or rotor, are connected. In starting the brushes—in pairs cross-connected—rest upon the commutator. The motor starts on what is known as the "repulsion" principle. When the motor has attained full speed the brushes are lifted by a centrifugally controlled governor which, at the same time, acts to connect all the rotor coils, short-circuiting them in the same manner as in a squirrel-cage motor rotor. As is true of any motor the load driven should not be too much in excess of its rated capacity. If this type of motor does not come up to its speed, the brushes will not be lifted by the centrifugal governor but will continue to bear on the commutator.

The diagram, Fig. 1, shows the simple method of connecting the single-phase motor and starter. There is no third lug for connection to shunt field as with direct-current shunt or compound motors.

Squirrel-Cage Motors.

This type of alternating-current motor in common use has no commutator or slip rings. The current is supplied to the stationary stator or primary windings on the inner side of the frame, and induced currents are set up in the rotating armature, called the rotor. This motor corresponds, in a general way, to the constant-speed shunt-wound direct-current motor.

The torque at starting, efficiency, overload, capacity, etc., depend upon the design of the rotor. When installing this type of motor the service for which it is to be used should be carefully considered and the facts given the motor manufacturer. For ordinary all-day use and starting under light load, a motor of relatively low rotor resistance is best. But for intermittent use and short periods of duty where a higher starting torque is required a higher resistance rotor is more satisfactory, although the all-day efficiency of the machine is lower.

Because of the absence of brushes, commutator or any other exposed current-carrying parts—as can be seen from Fig. 14—the squirrel-cage motor is well adapted for use in locations where dust, lint, or vapors are present. If arranged for starting under light-load

conditions, they are very satisfactory for saw mills, planing mills, textile mills, cereal mills, and similar service.

Small 110, 220 and 440-volt motors up to about five horsepower are often connected to the circuit by a three-pole or four-pole—for two phase—knife switch, with starting and running fuses as indicated in Fig. 5. This causes an inrush of current at starting, varying between three and nine times the normal running current; but as this is proportionately small for small motors, the disturbance to the line is not generally considered undesirable. The switch should have a spring so that it will not remain in the starting position except when held there.

Fig. 4.—Single-Phase Motor of the Self-Starting Type.

For larger capacity motors the heavy starting current causes trouble in line regulation and means for reducing the current must be considered. Three types of starters are in use, the compensator or auto-transformer, the star-delta switch and the primary resistance starter, the first of which is used most. These three devices are illustrated in Figs. 6, 7 and 8.

Compensators.

A compensator is the equivalent of a step-down transformer. By impressing a lower voltage on the motor stator at starting, the heavy starting current is reduced. As the torque of the motor depends upon the voltage supplied to the stator winding, decreasing the voltage, however, decreases the torque, and this is the reason for the necessity of starting squirrel-cage motors of the ordinary design under light load. To get full starting torque, the full rated voltage is required at starting, and this causes the undesirable heavy current inrush.

Fig. 6.—Star-Delta Switch.

The compensator consists of cores and windings, a cable clamp at the top of the case for securing the leads and keeping them separate and a contact switch immersed in oil in a metal case at the bottom—in the wall type—operated by a side lever as illustrated in Fig. 7. Each winding has several taps which are indicated on the connection drawings, Figs. 9 and 10. The three windings of the three-phase compensator are connected in Y and when installed the line wires are connected to the free ends of the Y, and the leads of the motor to the taps. In two-phase compensators each phase of the line is connected to the ends of each of the two coils and the starting connections of the motor to the taps and one of these ends. Fig. 8 shows the connection diagram for a two-phase motor and compensator of this type.

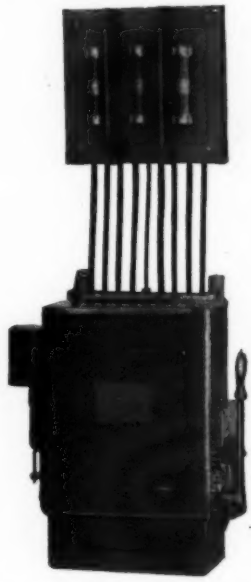


Fig. 7.—Starting Compensator.

The taps ordinarily provided for compensators up to 20 horsepower give 50, 65 and 80 per cent, respectively, of the line voltage, and under given conditions the respective currents taken by the motor while starting will be 25, 42 and 65 per cent, respectively, of the current that would be taken if the motor were thrown across the line without a starting device. The second tap giving 65 per cent line voltage is usually the one connected. In the case of a motor requiring a running current of 10 amperes per phase and 70 amperes on starting without a compensator, the 65 per cent tap would cut this down to 42 per cent of 70 amperes or to about 30 amperes. For large motors four taps are provided giving 40, 58, 70 and 85 per cent of the line voltage.

The lever on the side of the case, Fig. 7, has three positions: "start,"

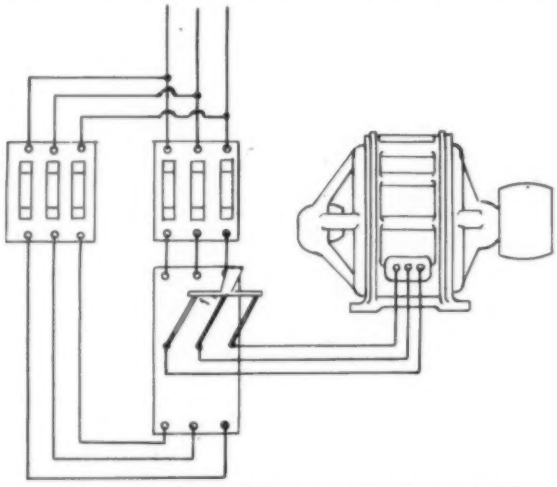


Fig. 5.—Starting and Running Circuits of Small Squirrel-Cage Motor.

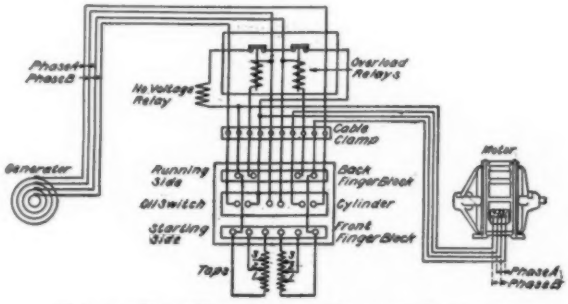


Fig. 8.—Two-Phase Connections to Compensator.

"run" and "off," the latter at the center. Throwing this lever to the "start" position throws the oil-immersed switch inside; in the position connecting the motor to the reduced voltage taps. The motor should pick up in speed in less than a minute. If it does not, the voltage tap should be changed to allow a higher voltage to be impressed on the motor. When the motor has picked up the lever must be passed with an uninterrupted movement over the "off" point to the "run" position. In this position the switch connects the motor directly to the line. The fuses, as seen in Fig. 9, are only in circuit after the switch is in the running position and line or starting fuses must be provided. The leads to the motor must be protected by fuses or circuit-breakers. Overload release coils, as shown in Fig. 10, may be substituted for fuses and are better, since protection is provided against running single phase. The matter of fuses will be referred to again later.

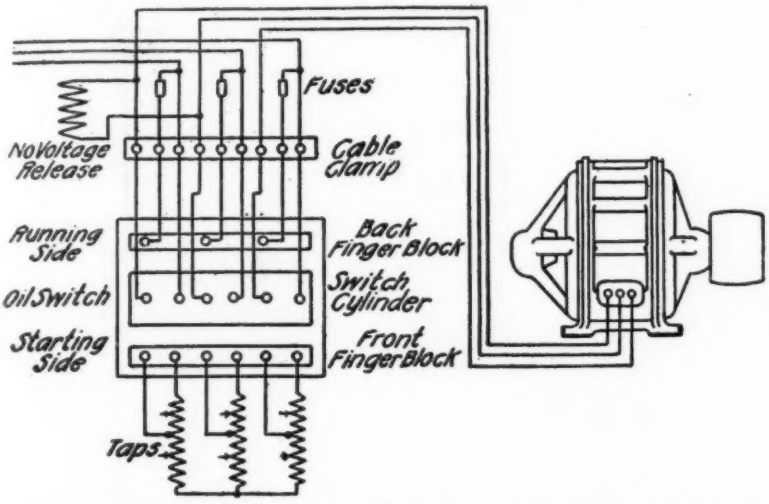


Fig. 9.—Connection Diagram for Three-Phase Squirrel-Cage Motor and Starting Compensator.

As the compensator switch disconnects all line leads when the lever is in the "off" position, a separate main-line knife switch is not required. The no-voltage release throws the switch to the "off" position in case the current supply is interrupted while the motor is running.

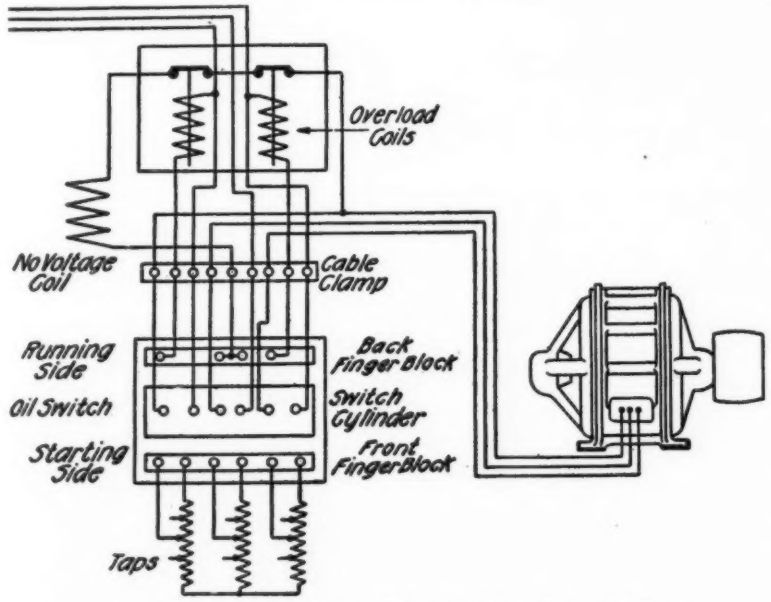


Fig. 10.—Overload Release Coils Used in Place of Fuses.

Star-Delta Switches.

Star-delta type starting switches are used to some extent with small three-phase squirrel-cage motors—up to 550 volts—that have their stator windings so arranged that the starting position of the switch connects them in star or Y and the running position connects them in delta. The switch is of the rotating drum type, oil-immersed and operated by a handle at the top. Like the compensator, this switch has three positions—"start," "run" and "off." In the last position the motor is entirely disconnected from the line.

In the starting position the switch connects the stator winding in star, as shown in Fig. 12. This has the same effect as reducing the voltage by means of a compensator, but this switch is cheaper. As two sections of the windings are in series across each phase, the voltage of each will be reduced to 58 per cent of full line voltage. As in the case of the diagram, Fig. 12, the voltage at starting in each phase is 128 instead of 220 volts. This reduces the current to about 35 per cent of what it would be if no starting device were employed. In the running position each phase of the stator winding receives the full line voltage as shown in the diagram. Separate primary windings are not needed but leads are brought out from the ends of each phase winding, which makes possible their connection in either star or delta.

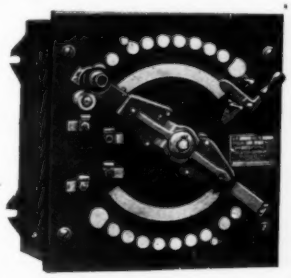


Fig. 11.—Primary Resistance Starter for Squirrel-Cage Motor.

The operation is similar to the compensator; that is, in passing from the starting to the running position the lever must be moved with an uninterrupted movement and it is not possible to throw the lever to the running position first. No-voltage release for returning the handle to the "off" position on failure of voltage, and overload release for the same purpose on overload of motor, can be provided also. As the switch is oil-immersed and inclosed, it is suitable for use where dust or vaporous gases are present, as well as in the ordinary location. In some cases the line fuses are cut out on starting or separate higher capacity fuses provided for starting service. Fuse protection will be discussed later, however.

Primary Resistance Starting Rheostats.

Rheostatic face-plate type resistance starters are also used with two-phase

and three-phase squirrel-cage motors to some extent. These starters, one type of which is shown in Fig. 11, if operated with care so as not to cut out the resistance too rapidly, give very good service with motors up to 20 or 25 horsepower on 110, 220, 440 and 550-volt systems. Of course, the power dissipated in the rheostat is wasted, but unless frequent starting is necessary this is not of much consequence. Gradual acceleration is possible, for after the motor begins to speed up the torque developed increases and the operating lever can be moved over the last segments more rapidly than over the first.

The full resistance of the starter in two phases reduces the voltage impressed on the motor to about 45 to 50 per cent of the full line voltage. If this does not start the motor, the lever is moved to the second segment, which cuts out some resistance and allows about 60 per cent of the line voltage to reach the stator windings of the motor. Further movement of the lever cuts out more resistance until finally the motor is connected directly to the line. The diagram, Fig. 13, shows the operating principle of this starter.

The choice of starting device for small squirrel-cage motors depends upon the service for which the motor is to be used. For large motors the compensator only is in use. The following comparative data give the list prices, shipping weights, etc., of standard starters of the three types for 220-volt, 25-cycle service.

Capacity in Horsepower.	Type.	Style	List Price With No-Voltage Release.	List Price Without No-Voltage Release.	Shipping Weight in Pounds.
7.5	Compensator	Inclosed	$90.00	$75.00	200
7.5	Star-Delta	Inclosed	62.00	45.00	75
7.5	Primary Resistance	Open	37.00	28.00	50

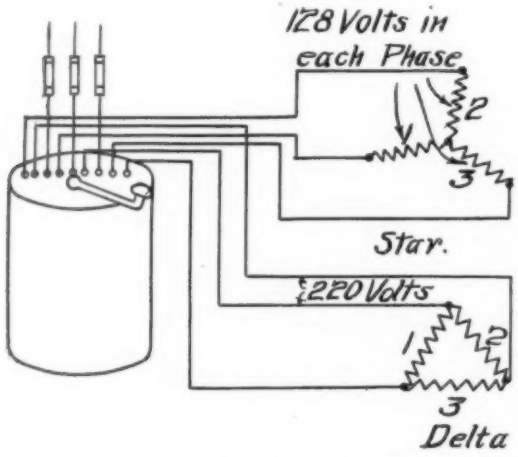


Fig. 12.—Connection Diagram of Star-Delta Switch.

Fig. 14—Squirrel-Cage Induction Motor.

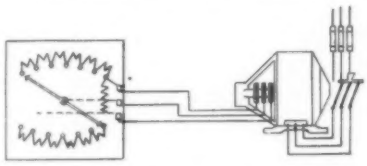


Fig. 15.—Diagram of Secondary Resistance.

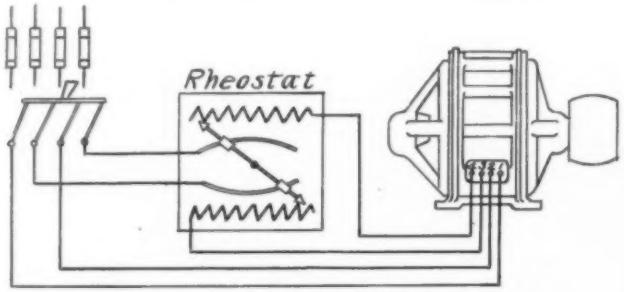


Fig. 13.—Diagram of Primary-Resistance Starter.

Slip-Ring or Wound-Rotor Induction Motor.

The action of the wound-rotor motor is similar to that of the direct-current shunt motor. The winding of the primary circuit is the same as for the squirrel-cage motor and the current is supplied to this circuit. The secondary or rotor windings are brought out to slip rings which are placed on the rotor shaft. Leads are brought out from brushes which rest on the slip rings, one on each ring, and make possible the inserting of resistance in the rotor windings. Fig. 2 shows a wound-rotor type three-phase induction motor. The three leads to the left are the leads coming from the slip-ring brushes.

Wherever the motor load is a considerable proportion of the load on a generator; where the load at starting is heavy; or where speed variation is required, the slip-ring motor is better suited than the squirrel cage. The starting torque is greater, starting current less and the acceleration more uniform, although not so good as for a direct-current motor.

Many central stations place restrictions on the use of squirrel-cage motors. Some require all alternating-current motors of greater capacity than 30 to 35 horsepower to be of the slip-ring or wound-rotor type to prevent line disturbance due to large starting currents.

The usual method of starting the wound-rotor induction motor is by means of an open face-plate rheostat, a multiple-switch starter or inclosed drum-type starter. The first is for motors of comparatively moderate capacities—up to 30 or 40 horsepower—and where the open sliding contacts are

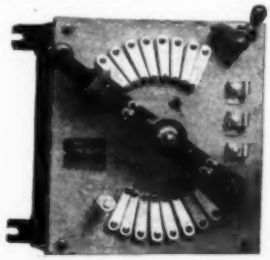


Fig. 16.—Starter for Slip-Ring Motor.

not objectionable. The diagram, Fig. 15, shows the connections of the rheostat and the fuses and switch in the primary motor leads. These starters, one of which is illustrated in Fig. 16, limit the starting current to about 150 per cent of the full-load current.

As the induction motor consists of a primary and secondary, like a transformer, inserting resistance in the secondary and cutting down the current results in less current being taken from the line by the primary or stator winding. As the motor picks up and the resistance is cut out step by step the normal speed is reached. At this time the windings of the rotor are short-circuited and the operation is like the squirrel-cage motor.

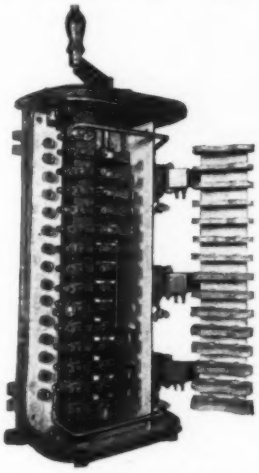


Fig. 17.—Starter for Slip-Ring Motor.

In locations where considerable dirt or dust is present, the inclosed drum-type starter is better suited. This starter, illustrated in Fig. 17, is operated by a handle at the top and the revolving cylinder, carrying segments, makes successive contacts with stationary fingers. This cuts out resistance in the same way as with the wall-type open-contact starter. As with this latter starter, a main-line knife switch and fuses or a circuit-breaker must be installed in the primary leads of the motor. Before operating the starter, the main switch, of course, must be closed.

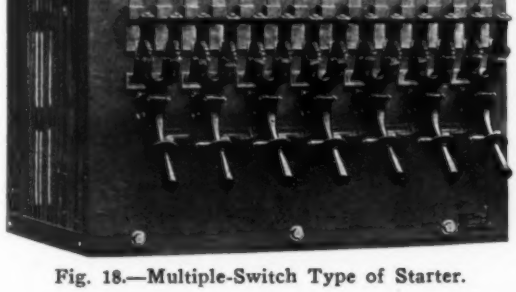


Fig. 18.—Multiple-Switch Type of Starter.

For motors of 150, 300, 500 horsepower, etc., or where starting conditions are particularly severe, the multiple-switch type of starter illustrated in Fig. 18 is better able to handle the large currents. The cutting out of successive steps of rotor resistance is accomplished by separate levers so interlocked as to allow closing in only the one way. The first lever, when closed, holds the next one, thus closing the switches hand over hand, introduces a desirable time element preventing too rapid cutting out of the resistance. Pushing the lever handle down or against the slate front forces laminated copper brushes against copper contact plates and makes firm contacts. Because of the large currents for which this type of starter is designed, auxiliary contacts are provided for breaking the arcs, when opening the circuit, and preventing wear of the main current-carrying contacts of the switches. With the types of starters described, the main-line switch in the primary circuit must be closed first and then the starter operated at once to cut out the resistance, which is designed for starting duty only.

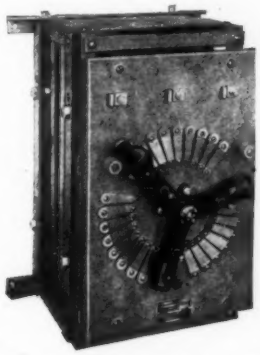


Fig. 19.—Three-Phase Motor Regulator.

The slip-ring motor can be employed for duty requiring variations in speed. It does not exactly correspond to direct-current motors in this respect, as it is not possible to vary the speed through as wide a range. It has the characteristics of a direct-current shunt motor with armature control; that is, if the normal speed is, say, 900 revolutions per minute, it is possible by inserting resistance in the secondary motor circuit to reduce the speed in a certain number of steps down to half speed, or 450 revolutions per minute, under full-load conditions. The speed of a direct-current motor can be raised above its normal value, but this cannot be done with the alternating-current slip-ring motor.

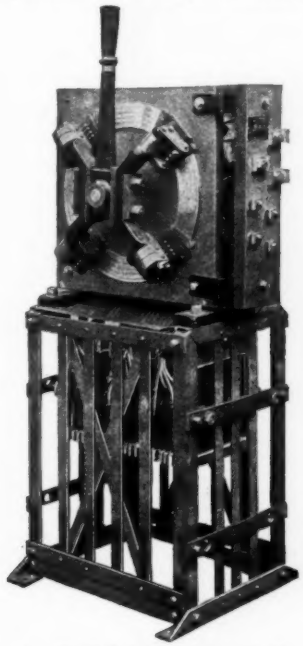


Fig. 20.—Radial-Arm Type of Controller Used on Cranes.

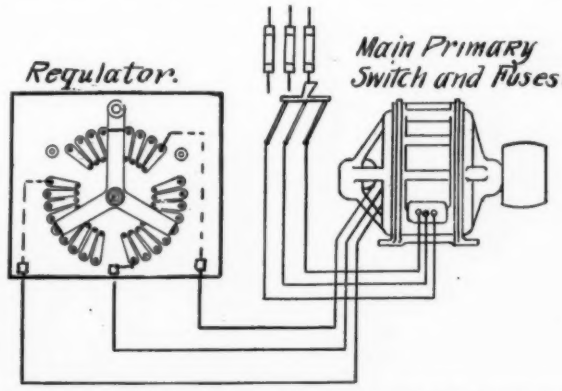


Fig. 21.—Diagram Showing Primary Switch and Fuses and Regulating Rheostat in Secondary Circuit.

Slip-ring motors, with speed regulators or controllers, are used to a considerable extent for operating large

fan systems, centrifugal pumps, reciprocating pumps, machine tools, hoists, cranes, elevators, printing presses, and for constant-speed work where starting must be done under load.

For varying the speed of the slip-ring motor the most common method is by means of the insertion of resistance in the rotor circuit. For small or medium-sized motors the face-plate type of regulator shown in Fig. 19 can be used, while for larger motors and where an inclosed regulator is desired the drum type, similar to the starter in appearance—see Fig. 17—and the multiple-switch type may be used.

The principle of operation is the same in all three types mentioned: three resistances are divided up into sections that can be gradually cut out by moving the regulator arm. When at slow speed, the three-phase windings of the rotor are connected with the resistance in series with them. As the regulating arm is passed over the contacts, resistance is cut out and at full speed the regulator short-circuits the rotor windings. The diagram, Fig. 21, shows the manner of connecting the regulator and motor. Primary switch and fuses must be provided.

With the drum-type inclosed regulator, Fig. 17, the resistance is mounted in a separate grid bank, as it is too bulky to mount in or behind the controller. Reversible controllers for cranes and similar service have in addition to the regulating segments and fingers an oil-immersed main-line combined line and reverse switch, usually placed in a closed steel tank below the drum and operated by the same shaft. The radial-arm type of crane controller for slip-ring motors, sometimes used, is illustrated in Fig. 20.

Electric Car from Boston to New York.

On March 21 the first trolley car to make the trip between Boston and New York City arrived at the New York terminal. This car carried officials of the Street Railway Club of Boston and of various eastern lines. The car left Boston about 8 a. m. on Wednesday, arriving at New Haven about 8 p. m Passengers remained over night in that city and the remainder of the journey was completed on Thursday between 8:30 a. m. and 3 p. m., being somewhat delayed by the snow.

Although previous trips have been made between Boston and New York on electric cars, no single car has ever before made the entire trip. It was necessary to lay several hundred yards of track near Stamford, Conn., in order to complete the through connection.

Among those who made the trip were H. C. Donecker, secretary of the American Electric Railway Association; T. M. McCarter, president of the Public Service Corporation of New Jersey; E. C. Foster, president of the Manchester (N. H.) Electric Lighting & Railway Company; and C. S. Clark, secretary of the Massachusetts Street Railway Association.

AN INTERESTING JOB OF REPAIRING.

By H. G. Wilson.

Throughout the country in large towns there are a number of so-called fireproof buildings having brick walls, steel or cast-iron columns, tile partitions, metal lath and plaster ceilings and wooden floor supports. At the time these were built it was considered good practice to lay the wires in the plaster on the tile partitions. Requests are frequently received for electrical inspection in these buildings, chiefly on account of the serious condition of wiring in shafts and closets, and decided opposition is usually met with from the owners when specifications are presented for bringing the equipment up to the present-day standard. This opposition is mainly on account of damage occasioned thereby to walls and partitions.

In a case of the kind in question the following compromise was, after much discussion, effected to the satisfaction of all concerned.

The branch circuit wires laid in plaster constituted practically no fire hazard in the minds of many fire-insurance men, and open wiring, molding, flexible or rigid conduit work was prohibited on account of appearance. It was agreed to subject this wiring to an insulation test of 1,500 volts, alternating current, and if breakdown occurred to replace those particular wires. All wires at outlets were bushed with loom as far back as this could be pushed, which in some cases was seven or eight feet in the ceiling. The service entrance was replaced with standard work and new feeders were run in conduit to the cut-out cabinets throughout the building. All defective fuses, cutouts and cutout cabinets were replaced, and wires at meters were bushed where not separated two and a half inches and rigidly supported. Where it was possible, all fixtures were rewired, and when this could not be done owing to the design, new fixtures were installed. Insulating joints, canopy insulators and approved sockets were provided.

This it was believed would give as safe an installation as possible under existing conditions without unnecessarily tearing down plaster with all its attending annoyances to tenants.

LETTERS TO THE EDITOR.

Power Rates in Chicago.

To the Editor:

In your March 23 number, in the article by H. J. Macintire on "Advantages of the Combination Ice Plant," it is stated on page 577 as follows:

"The rate in Chicago is about four cents for off-peak loads, but there is a sentiment to discriminate in favor of the ice man, which will result probably in much better rates."

We wish to correct this statement and say that for off-peak business such as the making of artificial ice, our rates have never been as high as four cents per kilowatt-hour. We do not know where Mr. Macintire got his information, but an application to any one in this company who understood our rate would have convinced him that our rates are very much lower than this. We have an established off-peak schedule for alternating current for business as large as 200 kilowatts capacity and over. Assuming a yearly load-factor of about 60 per cent, which we believe to be correct for an artificial ice plant in this latitude, the rate earned would be very little in excess of one cent per kilowatt-hour.

These rates do not necessarily apply to ice manufacturers only. Any manufacturing plant having the same load-factor and the same kilowatt demand used under the same conditions could secure this rate.

E. W. Lloyd,
General Contract Agent, Commonwealth Edison Company.
Chicago, Ill., March 23, 1912.

Wiring in Flour Mill.

To the Editor:

In the issue of March 16 of your journal I was much interested in the article by Mr. Victor J. Conklyn. As manager of a branch office of an electrical construction business, I would say that, although we have never wired flour mills, still we have installations along similar lines, and, in my opinion, the inspector was extremely lax and very likely ignorant of the rules, inasmuch as he passed open-link fuses in such a place, and, also, wire supported fifteen to twenty feet on the beams. Of course I do not know the exact conditions, but I believe that if I were the inspector I should have required iron conduit, plug fuses in metal cutout cabinets, keyless sockets on reinforced lamp cord at least, but preferably the armored flexible cord.

J. A. Clarner.
North Attleboro, Mass., March 21, 1912.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

When the Blow Torch Does Not Work Right.

Very often we notice a blow torch which will not generate properly. The flame will be white and not have the hot, blue point which is desirable. To remedy the trouble, be sure it is not due to leakage of pressure by a poor packing or valve; then enlarge the holes in the burner tube to give the jet more air—bore out the holes nearest the valve point, and you will be surprised at the result. The writer made the above discovery after considerable tinkering with torches and found it to give excellent results. There may be a difference in gasoline; some kinds may require more air mixed with it than others. The manufacturers may use a certain kind to test the torches with at the factory. Then, again, after a torch is used some time the burner tube may burn away and it may lose its heat conductivity and not generate properly; otherwise it would seem that the manufacturers would make the air holes large enough in the first place.

Ed. M. Raetz.

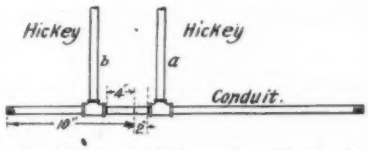
Locating Short-Circuits in Lighting Fixtures.

Some time ago I noticed that in a wiring kink by Fred A. Jerram it was recommended that when a short-circuit develops in any of the fixtures on a given lighting circuit a 32-candle-power lamp should be installed in one of the fuse receptacles of the cutout base and the exact location of the fault determined by noting which of the lamps burn red and which do not burn at all. Mr. Jerram stated that if the lamps on any fixture did not glow at all the wireman would be certain to find the trouble in this particular fixture. I have found, however, that none of the lamps except that in the cutout will burn while the short-circuit continues. After the trouble is cleared up the lamp in the cutout will burn in series with the lamps that happen to be turned on in the circuit and the more lamps turned on the brighter will the cutout lamp be. My way of going about this job is to insert a lamp in the cutout and then turn off or disconnect one fixture at a time until the remaining lamps begin to burn.

James B. Wilson.

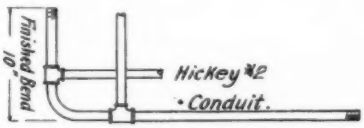
Conduit Bending.

Where a standard bending machine is not available wiremen frequently experience difficulty in bending conduit for electric circuits properly. Sometimes one has to bend the tube back and forth and continue to measure the bend until, by sort of cut and try process, he strikes the right height. Moreover, all makes of conduit are not of the same flexibility and the measurements given may have to be changed by the workman to suit the particular brand of tubing with which he is working. I have found the procedure outlined in the following paragraph to be very satisfactory in the work of the kind under consideration.



Positions of Hickeys for Ten-Inch Bend.

For half-inch conduit lay off the position of the bend from one end of the pipe and mark it with chalk or a pencil. Now mark a point two inches further from the same end than the first mark, at which point place a "hickey" or bender, as at *a* in the first of the two figures. Then from the first mark, mark a third point four inches back toward the end of the conduit and place the second hickey there—see *b* in the figure. The conduit may then be bent readily by bringing the handles of the hickeys together. The second figure shows the finished bend.



Pipe and Hickeys When Bend is Complete.

In the case of three-quarter-inch conduit the respective distances between the points marked should be five inches and three inches; while for an inch pipe these points should be six inches and four inches respectively apart.

George Reed.

Fishing Wires in Electric Fixtures.

In fixture work the electrician sometimes finds it very difficult to get the wires through the stem and arms. A simple way to overcome this difficulty is to use the small chain from a chain pull socket. The acorn end should be cut off and a string fastened to the chain. This latter being small and flexible, will go through the desired channel, passing all the turns readily.

Howard S. Barney.

A Problem in Bell Wiring.

Having to connect up two ordinary door bells in series, one of which was of a relatively high resistance and the other of low resistance, I found it almost impossible to get both of them to ring at the same time. Either one or the other would only buzz while the remaining one was ringing. I overcame the difficulty by cutting out the vibrator of the high-resistance bell and making the low-resistance unit make and break the circuit for both of them. Thus both bells were made to ring evenly and clearly.

A. L. Cameron.

Should the Pipe Be Flooded in This Way?

I have sometimes seen jobs in which a considerable length of underground pipe must be installed without disturbing the surface of the ground in which it must be placed. One terminal of the pipe circuit being in the cellar or some such place, the undertaking may be accomplished in the following way: A pipe or bar several feet long is driven in the required direction, the driving being done from the cellar or basement. Then a length of the tubing to be used is inserted, and on the outer end of this a tee with a nipple and cap is screwed. As the next step a garden hose is attached to the branch of the tee and water turned into the pipe. The pressure of the water wears away the dirt around the forward end of the pipe, so that by gently driving on the cap at the tee the pipe can be advanced steadily. When the first length of the pipe is driven entirely up, a second length is attached to it with the proper coupling, of course. A case came to my attention recently where a man pushed a pipe all the way under and across a macadam street this way and came out within two feet of the pole which he was aiming to reach.

Charles E. Henney.

A Handy Tool for Wiremen.

Some wiremen always carry in their grip either a faucet handle or a wheel off of a small globe valve. The hole in either one of these will fit the shank of an ordinary bit and thus sometimes make it possible to bore a hole in a place where there is not room enough to use a brace of the ordinary kind.

Charles E. Henney.

Among the Supply Men

Electrical Merchandising.

"A place for everything and everything in its place" should have been the title of Judge Debevoise's talk to the New York Jovians on March 20, for it was very much to this point in telling just what relations the various branches of the electrical industry, represented by the central station, the manufacturer, jobber and the contractor bear to each other. In his discussion of where the middleman stood and of his value to the public, he used copper for his basis, and told just what hands or interests it passed through from the mines until it appeared as a useful part of some electrical device in use by the consumer.

Judge Debevoise spoke of the present government investigations and the efforts on the part of the Government which would in the next few years tend to eliminate from any field the useless middleman—the middleman who did not render to the ultimate consumer a real service, or who did not in return for his profit give a service of value to the manufacturer in helping to distribute to the consumer more economically than the manufacturer could distribute himself.

In the electrical industry, he said that the various branches were or should be an unbroken chain, from the manufacturer to the jobber, and thence to the central station and contractor or small dealer, who dealt direct with the public—the former by its sale of current and the latter by the sale direct to the public of appliances and various current-consuming devices.

Continuing further, he explained how very logical it appeared that the manufacturers should market their products through the numerous and well placed jobbing houses, who were not only in a position to carry stocks, so that material could be economically and quickly delivered, but who could keep track of and carry local credits where the manufacturer could not, and who could also assist by bearing a certain proportion of the advertising and all the selling expense. For these and many other reasons, the jobber *did* render an actual and valuable service to the manufacturer and his customer.

Clashes of these various interests had occurred and were occurring, but through the Sons of Jove, the various local luncheon clubs and in many other ways they were all coming to meet and really know one another. Through their all honestly recognizing that the line of demarcation was drawn fine, as it must be in the electrical industry, and through open discussion and fair dealing and fair competition on the part of all, these differences were surely, through perhaps slowly, being eliminated.

Common sense would show any one the writing on the wall, which was clearly that individual prosperity could only come from the prosperity of all, and for the maximum of prosperity it was necessary for all to work together. That the industry was awaking to the economic waste of absolutely individual effort was demonstrated by the appearance in fifteen different newspapers of a co-operative electrical page—a page in which all local and some national interests co-operated for the education of the public as a whole to things electrical.

By this and by the formation and successful operation in many different parts of the country of co-operative Jovian luncheon clubs, which brought the various interests together for joint discussion and work which tended toward the development of the industry, and in many other efforts which were being made toward real co-operative work, Mr. Debevoise said that the manufacturer, the central station, the jobber and the contractor were each coming more surely to take his place in the continuity of effort which would give to the public a perfect and an economic service, which together with the efforts towards greater education, was developing rapidly and more rapidly the growth of the industry and the prosperity of all.

The meeting closed with a statement by F. E. Watts, New York Jovian statesman and chairman of the club, that the committee appointed to carry out the publication of the co-operative newspaper page in New York City reported that it had already arranged with two of the papers as to the rates, etc., and that work had commenced for arranging for space with advertisers and that the committee hoped that in the course of a very few weeks all the space in the two papers would be contracted for.

Supply Men and Their Interests.

Supply men have been scurrying to get out new price lists on bare and covered wire to cover the jump in copper In this connection the statement of Adolph Lewinsohn, president of the Miami Copper Company, and a director in other mining and smelting companies, is of interest. "The copper market," he said, "is in excellent condition. Stocks of the metal everywhere have been greatly reduced and are now very moderate. The advance has been gradual on actual demand. At present the price is firm at 15 cents a pound, and only limited quantities are to be had at that figure. I am of the opinion tha when the strike situation in England has clarified, demand for the metal in that country will materially increase. I believe copper will further advance and within a reasonable time reach 16 cents a pound. While it is true that most of the larger producers are making good profits at present prices, yet it must be taken into consideration that good copper mines are very scarce.

"The mill of the Miami Copper Company has about been completed, and the company is producing at the rate of approximately 3,000,000 pounds of copper a month. I am extremely optimistic in regard to the future of this property and of the metal market."

Waldso Turner, who has been connected with the Iron City Engineering Company, Pittsburgh, Pa., for some time, has established headquarters at Detroit, Mich., assuming the management of the company's Detroit branch.

The Price Electric Company, 413 Liberty Street, St. Paul, Minn., announces that it has completed an arrangement with the Ideal Electric & Manufacturing Company, Mansfield, O., to represent it. Mr. Succop has been appointed general sales manager of the Ideal Electric & Manufacturing Company, and will make his headquarters at the main office in Mansfield. He has had many years' experience as a salesman of electrical apparatus, and will give his entire attention to the problems involving commercial adaptations of motors and generators, particularly as applied to industrial plants.

Legal Notes

THE RIGHT OF EMINENT DOMAIN.

By Maguire and Mooney.

The right of eminent domain extends to all companies serving the general public in a capacity tending to the general welfare, and without discrimination. This applies to electric companies in all but four states. Actual public service must be performed, however, and not merely be in contemplation, in order to exercise this right.

The right of eminent domain is a right that is given to few. It is one of the extraordinary rights that must be exercised for the benefit of the public. Even the State itself cannot condemn property unless it is for the benefit of the public.

Whenever the public use of property requires it, the private rights of property must yield to this paramount right of the sovereign power to take it for the public use. It is always the character of the use for which the property is taken that determines whether it is legally taken under a proper exercise of the right of eminent domain. The general public must have a definite and fixed use of the property to be condemned; a use independent of the will of the private person or private corporation in whom the title of property when condemned will be vested. And this use must be clearly a needful one for the public, which cannot be given up without obvious loss and inconvenience. It must be impossible, or very difficult at least, to secure the same public uses, and purposes otherwise than by condemning private property. It will not suffice that the general prosperity of the community is promoted by the taking of private property when no public benefit is conferred.

This is well illustrated by Avery vs. Vermont Electric Company, 203 Pa., 525. The company desired to raise the dam on the Winooski River to the height of fifty feet, proposing to use the water power so developed in generating electricity for the operation of the Burlington & Hinesburgh Railroad. They petitioned the court to permit them to raise the dam and to ascertain the damage that would be caused thereby. The court had to first determine whether the use to which the water power would be put would be a public use or not. The use of electricity has become so important to the prosperity and development of cities and states that the company contended that the utilization of the water power for its production should be regarded as a public necessity. The court in deciding the matter determined that the wheels of progress should not be blocked by an obstinate or grasping owner, and that if this was for a public benefit the land of individuals could be condemned. But this electric company was not bound to serve the public directly. The only way in which they could have served the public was in providing the motive power for a railroad, and the railroad was undoubtedly a public carrier. This indirect method was held not to be a public use, and the court held the company could not raise the dam. This was an entirely private enterprise and they could not condemn lands. But if the railroad company sought to condemn land to provide itself with a generating plant it would have been permitted.

There are many reasons why condemnation of private lands would assist an electric company, and the most important phase arises in the erection of transmission lines across the country and between cities. The only method by which such a company may have the right of eminent domain is through some positive authority of the state. That authority may exist in the state's constitution, in its statutes, or in the charter of the company, and the scope of this article is to determine the authority that eixsts in ordinary electric companies. Even if the charter of the company is not positive or definite on the question, but gives the company authority to establish its plant, there is the implied authority given it to erect its poles and wires. This implied power, however, cannot be extended to include matters that ordinary electric companies do not perform.

The taking of land for the purpose of supplying the public, or so much of the public as wishes it, with electric lighting, is for a public use. And in taking land the company may exercise its own discretion; it may go when and where it chooses; it may take whose land it chooses. But, if the company seeks to justify on the ground that the taking was for lighting purposes it must appear that it exercise the right actually for lighting purposes. Even though a company may have the power to exercise the right of eminent domain, it cannot exercise this right in all matters. The use for which the property is taken must be a public use. Sometimes a charter contains such a provision, permitting the company the power of eminent domain, but it is purely colorable, that is, that it was never intended to be used. And in the well known case of Brown vs. Gerald, 70 L. R. A., 472, the Sebasticook Manufacturing & Power Company was chartered to manufacture, generate, sell, distribute, and supply electricity for lighting, heating, and for other purposes, and in its charter it was authorized to exercise the right of eminent domain to establish its plant. The company was authorized to transmit electric power within certain towns and between them. The company had constructed its plant. It had then contracted to furnish its entire electrical current to one company for the period of ten years. From its plant to the plant of its one customer a line six miles long had to be constructed. The line was practically straight; it did not follow any roads in any place, but crossed 24 farms. It did not pass in close proximity to any buildings. One of the farmers objected to having any part of his land taken, and contended that there was no demand for electric current anywhere along the six miles, except for the one company. The court determined that right of condemnation was for the one purpose of supplying current to one company. The company contended that it should not be judged by its beginnings because it was ready to furnish electricity to all along the line who wished it and were desirous of using it. The court held this an insufficient answer, because however willing the company might be to furnish current to all that might desire it, the company did not expect and contemplate transmitting a current for any other than the one customer. The one customer purchased the entire out-

put of this plant, and even if the electric company desired to furnish current to customers along its six-mile course it could not do so without violating its original contract.

The demand for power is of a public character. Like water, electricity exists in nature, in some form or state, and becomes useful as an agency of man's industry only when collected and controlled. It requires a large capital to collect, store, and distribute it for general use. It may happen that the business cannot be inauguated without the aid of the power of eminent domain for the acquisition of the necessary land, or rights in land. All these considerations tend to show that the use of land for collecting, storing and distributing electricity, for the purpose of supplying power and heat to all who may desire it, is a public use, similar in character to the use of land for collecting, storing and distributing water for public needs, a use that is so manifestly public that it has seldom been questioned and never denied.

The use of land for constructing and maintaining a line of wires to conduct currents of electricity employed in lighting public streets, highways, or for use in operating manufactories, is a public use within the narrower meaning of those words. Electricity is extensively used for the transmission of power from the point where the power is accumulated by means of a waterfall, or by the combustion of fuel, to distant points for use there; and the prospect is that it will be used in the near future to produce and distribute heat in a similar manner.

The true test as to whether a plant is operated for the benefit of the public is whether it is under obligation to supply electricity at reasonable rates, and without discrimination, to all persons desiring it, and being under such obligation, whether it can reasonably so do. The right of eminent domain should be exercised wherever the public interest will be subserved, when directed to purposes tending to the development of the natural resources of the state, or tending to the accommodation of the public welfare and convenience.

The Niagara, Lockport and Ontario Power Company was an electric transportation company operating in New York. It was engaged in constructing a line for the transmission of electricity from the city of Buffalo, eastwardly, to the central part of the state. Nearly all the land necessary for the right of way has been acquired and much of the actual construction work had been performed. The company desired two acres of land belonging to one Rosalie Flarke. She did not care to sell and condemnation proceedings were instituted. The court held that the furnishing of electricity for the use of the inhabitants in a thickly settled and extensive community such as that part of New York and the adjacent territory constituted a public use, and the company could condemn.—In re Niagara, Lockport and Ontario Power Company, 97 N. Y. Supp., 853.

There are two important matters that must be considered in exercising the right of eminent domain for electric companies. It must be first considered whether the use is a public use, and it has been seen that where the company only furnishes current to one company, or a few companies, that is not a public use. If a company is operating a plant that claims to furnish the public with current it must furnish all of the public who desire it at reasonable rates. This is restricted, however, to the territory in which the company is working. A person outside of the regular territory of the company could not demand current. It is also questionable sometimes whether a company that furnishes customers whose enterprises are all purely private has the power of eminent domain, and four states, Washington, Maine, Vermont and Missouri, have held that the selling of electric power to the public generally is not a public use for which the power of eminent domain may be exercised. These states, however, are some of the most sparsely settled and most backward states in the country and their doctrine is changing in the light of recent decisions of the courts.

The leading states of the country have ruled that the selling of electric power to the public generally is a public use, and New York, Indiana, California, and other prominent states have adopted this rule. It is the rule of all states save the four mentioned.

In constructing a transmission line to carry current to a distance, condemnation can be exercised only where the company has made provision to supply current to those all along the line, and especially to those at the point where the current is collected. A company, using part of the power of Niagara Falls to create its current, could not erect a line of wires and take all that current to a point miles distant, and still have the power of eminent domain. It would not be fair to those who lived near the falls and who desired to use some of the current generated there. So the company must cater at all times to all the public, and this means all the people desiring electricity in the territory in which its plant, wires and other equipment extends, and failing to do this it loses its right of eminent domain.

Interesting Cases.

DEFECTIVE BURGLAR-ALARM SYSTEM.—The Kings County Court of New York, holds that where a company installed and applied its system of electrical protection against burglary to a store, and the store was burglarized the burglar apparently entering from the cellar through a door in the floor, the wires guarding the same being cut, that an action could be maintained against the company for damages for breach of duty based upon the ground that its apparatus was at that time defective, as well as its servants negligent in the discharge of their duty. The court says too that the company would be liable for a careless actual interference with its alarm system, which caused an injury, as for instance, defective insulation, resulting in destruction of goods by fire; and it would not be relieved from the consequences of its negligent acts because it was also under contract obligations relative to the same subject-matter.—Silverblatt vs. Brooklyn Telegraph & Messenger Company, 132 N. Y. S., 253.

MAY YET REQUIRE WIRES TO BE LAID UNDERGROUND.—The Supreme Court of North Carolina says, in a case where a boy six years old was killed by taking hold of a guy wire left hanging loose for several months, that, at very small expense, the defendant, with notice of the dangerous situation, could, by the exercise of the slightest care, have prevented this accident, and the wonder is that it did not at once take steps to do so. It is no injustice or hardship to the defendant that the court holds it liable under the conceded facts of this case.—Ferrell vs. Dixie Cotton Mills, 73 S. E. R., 142.

CASE FOR STATE COURTS.—The Home Telephone Company, of Los Angeles, Cal., applied to the United States District Court for an injunction to restrain the city of Los Angeles from enforcing the ordinance which fixed the telephone rates. The City Council last July fixed the rates at the old value, refusing to permit an increase which the company demanded and which the Board of Public Utilities recommended. In refusing the injunction, the court ruled that it had no jurisdiction, the state courts being the proper place in which to bring suit. The claim that the rates are confiscatory is, if true, just as much a violation of the state constitution as of the federal constitution.

Exports of Copper.

Exports of copper for the week ended March 21 totaled 7,377 tons; since March 1, 19,067 tons; same period last year, 16,753 tons.

Public Service Commissions

WISCONSIN.

The Southern Wisconsin Railway Company has obtained a rehearing upon that part of the Commission's recent order relating to the establishment of a five-minute schedule over a portion of its main line, upon July 1, 1912. In the appeal made to the Commission, it was urged that at the recent hearing no proof was offered nor was any mention made or testimony given by any of the parties, nor by the engineers of the Commission, relative to the construction of switches, the building of double tracks or the advisability and possibility of operating a five-minute schedule or the necessity therefor. The company declared that it had no notice that the question of the expenditures of large sums of money for switches or double tracks was involved as an issue in the case and that therefore no opportunity was granted to present its side of the proposition. The company further showed that it would be physically impossible to comply with the terms of the order within the time specified and alleged that both the financial burden imposed upon it by the order and the establishment of a five-minute schedule were unreasonable and unwarranted. No date has been set for the hearing, but it is expected to take place some time next month.

Upon complaint that the local service rendered by the Milwaukee Northern Railway Company upon its interurban line between Milwaukee and Fond du Lac was inadequate; that the village of Mequon was being discriminated against in the matter of traffic accommodations; and that the fares now charged are excessive, the Commission caused a thorough investigation of the service rendered by the defendant company to be made, the results of which formed the basis of a recent order issued by the Commission. The investigation showed that the company's local service at the Milwaukee end of the line was grossly inadequate upon certain days of the week, in the summer. The cars were often overcrowded and usually ran far behind schedule time. In an effort to improve the situation the Commission ordered the defendant to improve its local service by double tracking a specified portion of its line; by extending and increasing its sidings; by acquiring additional cars, preferably of the city type; and by discontinuing the present hour and half-hour local service and substituting therefore a uniform twenty-minute service. That the present fares now in effect are not excessive was shown by a detailed analysis of the company's earnings and operating expenses. Even with the increased fares the company is earning less than three per cent upon the cost of reproducing the property. In using the cost of reproduction as a basis for computing the rate of return, instead of the present value, as is customary, the Commission stated that the company was entitled to a certain allowance for going value, and working capital in addition to the present value. The cost of reproduction exceeded the present value by about $245,400.

NEW YORK.

The Public Service Commission, First District, has begun an inquiry into the question of pressure used by the gas companies supplying gas to Manhattan and the Bronx. In the Stevens Law, which reduced the price of gas in these boroughs to 80 cents per thousand cubic feet, there was a clause providing for the maintenance of a certain pressure by the gas companies. The United States Supreme Court, in its decision upholding the 80-cent rate, declared the pressure clause unconstitutional. Thereupon the Public Service Commission employed W. A. Baehr to conduct an investigation. Mr. Baehr has completed his work and has made a report to the Commission.

The Commission has issued an order to the Interborough Rapid Transit Company, which operates the New York Subway, to install an emergency lighting system in all cars operated in the subway. These cars are lighted with electric lamps, supplied by the same cables which furnish power to the motors. The power current is sometimes suddenly shut off and this leaves the trains affected in darkness. The emergency system will furnish a certain number of lamps in each car which will be supplied by current independent of the power cables, either by storage battery or other device, and will be so adjusted that when the ordinary lamps go out the emergency lamps will at once automatically come into service. The order also requires the company to provide uniform illumination at stations, sufficient for reading purposes, on all platforms, and also to install tungsten or other metal-filament lamps in all cars. At present the cars in the express service of the subway are lighted by tungsten lamps, but those used on the local tracks are still lighted by carbon-filament lamps.

On March 22 the Commission opened bids for the construction of Section 2-A of the Broadway-Lexington Avenue Subway. Bids were received from the O'Rourke Engineering Construction Company, F. L. Cranford, Empire Engineering Corporation, Degnon Contracting Company and John H. Gray. The lowest bidder will not be known until the engineers of the Commission foot up and tabulate the bids, which were all upon the unit-price basis.

E. G. Connette, transportation engineer of the Public Service Commission, has made a report on the financial results of municipal operations as well as construction and equipment of the Broadway-Lexington Avenue Subway Line, which shows that even this route, which is supposed to represent the very pick of what is left in Manhattan and the Bronx, is likely to cause the city, if it undertakes to run it, a deficit for three years.

The cost of construction of the Broadway-Lexington Avenue route was estimated by the McAneny committee as being a little over $70,000,000, and to this must be added the cost of equipment if the city does not let the route out to any company.

OHIO.

A petition has been filed with the Public Utilities Commission asking for permission to connect the service of the Sandusky Telephone Company and the Vickery Telephone Company. The petition will be heard on April 1.

Sixteen telephone companies doing business in Ohio were summoned to appear before the Commission on March 27 to explain why they had failed to file schedules of tariff rates according to law. The law imposes a penalty of $100 a day for failure to submit reports.

CALIFORNIA.

California's new public utilities act went into effect on March 23. The act was passed by the Legislature at an extraordinary session in December, 1911. Broad powers are conferred upon the Railroad Commission.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within nine days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 54.—Resistances for Shunt-Motor Starters.—How are the resistances for a direct-current shunt-motor starting box calculated? How many contact points should there be? I have in mind building a starter for a five-horsepower, 115-volt motor that runs at 1,200 revolutions per minute.—S. N. T., Kansas City, Mo.

No. 56.—Light for Elevator-Car Threshold.—While visiting in another city recently I saw an interesting device to throw a light on the threshold of an electric-elevator car when the controller was thrown to "off" position. It seems to me it would be still better to have such a lamp light whenever the operator opened the door at any landing, the lamp remaining lighted until the door was again closed. Is there such a device on the market? How could the wiring be arranged?—J. M. R., Oshkosh, Wis.

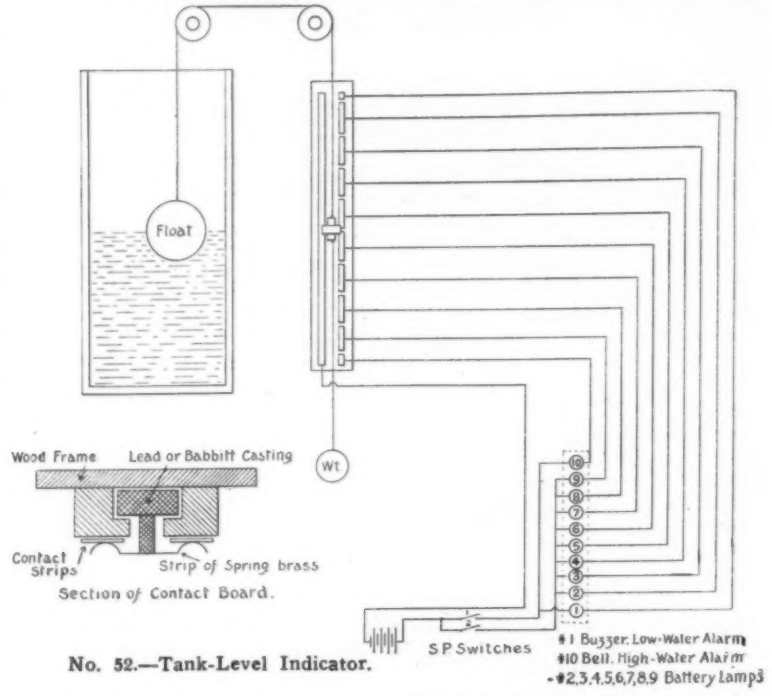
No. 57.—Operation of Moving-Picture Machines.—I understand that moving-picture machines are always run by hand and that motor drive is not permitted. Why is this? Would not a motor drive give a much more uniform speed and therefore produce a more regular and pleasing show?—H. V. N., Columbus, Ohio.

No. 58.—Series Circuits for Ornamental Street Lighting.—Why are most installations of ornamental street lighting with tungsten clusters made on multiple circuits, whereas all other street lighting is almost invariably on series circuits? I should think that series tungsten lamps would give better results than multiple lamps and circuit control would be much simpler.—P. R. J., Evansville, Ind.

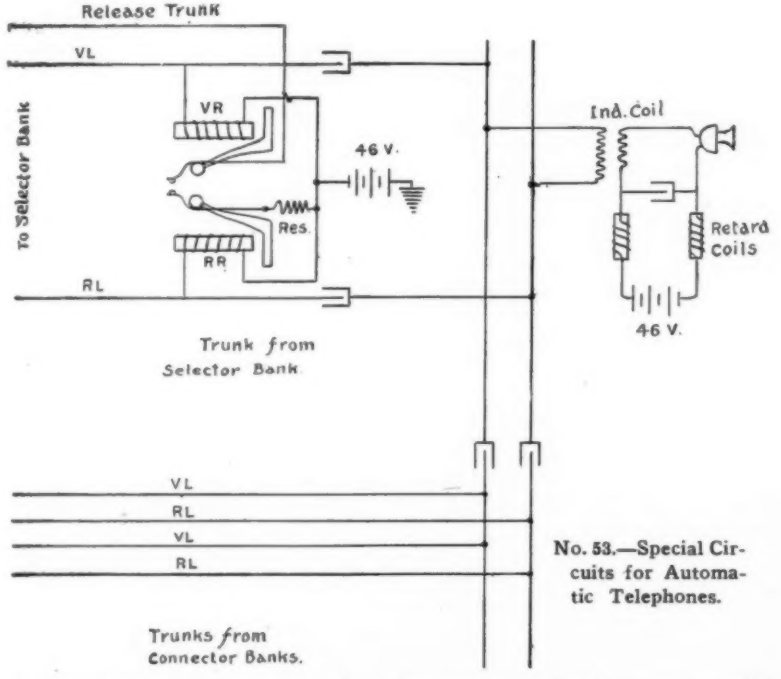
Answers.

No. 52.—Electric Level Indicator for Tanks.—Is there an electrical device for indicating at a remote point the varying height of water in a ten-foot tank?—J. A. S., Montreal, Canada.

The local light company gets its power from a dam a mile above the power house and the height of the water in the pond is registered on a gauge in the power house. The apparatus at the dam consists of a ball float connected by a chain to a sprocket wheel on the actuator. This sprocket wheel operates a little shaft on which are two contact makers so arranged with ratchets that when the float rises one contact maker is thrown over by means of the ratchet once with each inch rise of the float, the other contact maker remaining motionless on the shaft. When the float goes down, the little shaft, of course, revolves in the opposite direction thus engaging the second contact maker and releasing the first. In the gauge in the power house are two magnets whose armatures push a pointer around by means of a gear and pawls. The circuit consists of three No. 12 copper wires in a cable and energy is supplied by eight dry cells. The contact makers in making contact swing by so as to make only a momentary contact. When once set this apparatus works until the batteries are played out. In the case mentioned above three sets of cells lasted two years.—C. E. H., Unionville, Conn.



No. 52.—Tank-Level Indicator.



No. 53.—Special Circuits for Automatic Telephones.

While I am not sure that this is what the inquirer wants, I offer the diagram herewith as a solution to Question 52. The diagram is practically self-explanatory. If the weight behind the moving contact is made heavy enough, the weight marked *Wt* is not needed. Switches *1* and *2* should only be closed when finding the level of the water in the tank, but switch *1* may be left closed continually if the device is to be used in a pump house so as to give the engineer or attendant in charge an audible alarm when the water reaches the high and low points and thus warn him to stop or start the pump. This would be particularly desirable if he has other duties to perform that may take him out of the pump room. However, if the alarm feature is not wanted, a ten-point annunciator with the bell cut out can be used in place of the arrangement shown. In such a case, a switch or push-button should be put into the line to be closed when the water level is to be found.—W. H. B., Norwood, Manitoba, Canada.

No. 53.—Connection of Automatic Telephones.—We wish to connect a number of automatic telephones (they are of the three-wire, common-battery type) to a line running to a central location equipped with a common-battery transmitter. This system should be so arranged that any one subscriber can call a certain number and be connected to this line and also be able to hang up his receiver and disconnect without interfering with any other parties that may be on the line. Can this be done? If so, how?—R. B., Holland, Mich.

The circuits shown in the upper part of the accompanying diagram will answer if the calls can be handled from the banks of selectors. In order to prevent one subscriber from releasing another, it will be necessary to cut the multiple bank wiring and insert condensers between each switch, as shown; also a bridge for releasing must be attached to each trunk coming from each selector switch. When any subscriber who is listening hangs up his receiver, it grounds both the vertical and rotary relays *VR* and *RR*. These close the common contacts so that battery current flows from negative battery terminal through the release trunk and releases its connection without interfering with any other. So far as known, there is no way of allowing one subscriber to release without affecting the others unless condensers are inserted between each selector bank. If it is desired to use the trunks from the banks of connector switches, the arrangement shown at the bottom of the diagram may be used. Condensers must be inserted between the secondary winding of the induction coil of the common transmitter and the trunks in order that the back relay of each connector switch may not be energized when connection is made. Care must be taken to see that all the vertical wires are connected to one common bus and all rotary wires to another common bus so that one back bridge relay will not energize anoth r. If this is done, the back bridge relays will all remain de-energized and will not feed talking battery current to the calling subscriber. There will be very little disturbance when any one of the subscribers releases. It is assumed in both cases that it is not necessary to feed talking battery to the calling subscriber, as he desires to listen without talking. This also prevents the subscribers from talking to each other while listening to the common transmitter. Some trouble may be expected from the subscriber ringing when he has called the number; this remark applies only to the scheme shown in the lower part of the diagram. This can be reduced by the insertion of a small-capacity condenser, such as one-quarter micro-farad, in each tap from each connector-switch bank.—A. B. S., Chicago, Ill.

Producer Gas Power.

At a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and of the Electrical Section of the Western Society of Engineers, wh ch was held on the evening of March 25 in the Society's rooms, Monadnock Block, Chicago, H. F. Smith, of the Smith Gas Power Company, Lexington, Ohio, presented a paper entitled "Notes on Producer Gas Power."

Mr. Smith's paper was a very clear exposition of the principles of combustion, gasification and purification of gas with relation to the design and operation of gas producers. He showed that the percentage of hydrogen in producer gas must be carefully controlled in order to secure uniform explosibility. The regulation of the moisture content of the blast is very important. If steam is used for this purpose, the results are unreliable; hot-water moistening gives much better results. High temperature of the fuel bed is desirable, but this produces clinker troubles with most American coals on account of the relatively high percentage of ash therein contained. If the load on the engine is fluctuating, a considerable depth of fuel bed is necessary. Where more than one producer is operated in a battery the results are much more uniform than if but a single unit is employed. Mr. Smith dwelt at length on the influence of these considerations on the design of a producer and on its operation and maintenance.

Convention of the New England Section of the National Electric Light Association.

The two-day convention of the New England Section of the National Electric Light Association, held at the Kimball Hotel, Springfield, Mass., on March 21 and 22, was one of the largest and most successful that the section has ever held. The total registration was over 300.

The convention opened with the reports of the different officers and the President's address. A paper was then presented by L. L. Elden, of the Edison Electric Illuminating Company, Boston, entitled "Load-Factor and Power-Factor: How to Improve Them." This was enthusiastically discussed.

The session on Friday morning was opened by a paper by C. R. Hayes, of Fitchburg, entitled "The Relation of the Central Station to the Wiring Contractor." Mr. Hayes advocated co-operation between the central station and the contractor. It is necessary for the central station to take the initiative if it is to increase its business as it should, but it should concede to the contractor the right to do all construction work for customers. The contractor cannot go out and solicit business successfully unless the policy of the central station is such as to insure a positive demand for that which the contractor has to offer. The central station cannot undertake to create a large demand for wiring by means of advertising and solicitation unless assured of the support of the contractor. Co-operation is, therefore, essential. Views differ as to whether it is necessary for the central station to go into the wiring business to properly push a new-business campaign. The author thought that best results could be obtained if the contractor is allowed to act as intermediary in the process of connecting customers to the lines of a central station. The contractor should recognize that his business would be larger if the central station is aggressive and he should be ready to co-operate along the lines proposed by the central station. When a central station bears the expense of solicitation for new business, the contractor obtains the benefit of this solicitation, and it is natural that the central station should insist that popular prices be charged for the work. The failure on the part of the contractor to appreciate the justice of this often leads to a price-cutting campaign. The display and sale of electric appliances constitutes a legitimate method of creating a demand for central-station power, a point which is vital for the success of the central sta-

tion. The profit on a sale is a secondary matter. The author considered, however, that prices should be maintained so that the contractor is able to make a fair profit on his sales. Regarding incandescent lamps, the author stated that central stations should sell tungsten lamps only to its regular lighting customers.

This paper was very freely discussed. Wiring contractors were in attendance at the meeting for the first time in the history of the section and many were taken into membership in accordance with the new policy of the National Association, which is now urging electrical contractors to become Class E members.

Walter R. Eaton, of the Cambridge Electric Light Company, then presented a paper entitled "Exhaust-Steam Turbine as Applied to Electric Lighting." This described an installation which was very carefully designed and a wealth of valuable detail was given regarding the unit and a test of it. The exciter was separately steam-driven. Steam excitation is preferable for three reasons: (1) The fluctuations of voltage due to speed variations are not multiplied as is the case with a motor-driven set. (2) When a short-circuit occurs on the lines, the generator is not as liable to lose its load or "lay down." (3) Except in case of accident to the exciter itself, the load can be picked up more readily when a shutdown does occur than when the exciting unit is dependent for its power upon the main unit. A ten-per-cent saving was noticed in the coal bill during the past year, of which six per cent is attributed to the exhaust turbine. The results obtained indicate that the most important points in the selection of the complete outfit are a study of station conditions—in order to obtain the proper size and type of turbine to give the highest station efficiency. The generator should have its point of saturation sufficiently high to operate well under conditions of poor power-factor when such conditions are likely to occur. The selection of the condensing apparatus is dependent to a great extent upon the cost of feed and circulating water.

The morning session adjourned in time for the electrical men's luncheon, at which 300 were in attendance. Following the luncheon W. H. Blood, Jr., gave a very interesting and instructive lecture on "The Great Northwest, Its Resources, Beauties and Opportunities." This lecture was illustrated with lantern slides and was especially interesting to those contemplating attendance at the Seattle convention next June, as many views of Seattle were included.

Fred H. Smith presented a paper on "The Development of Electric Vehicles in New England." He referred to the uninviting history of the electric vehicle, which was pitiful largely because the manufacturer sold his vehicles independently and did not co-operate with the central station. The advent of the Electric Vehicle Association of America had greatly benefited the vehicle industry, and the present mutual understanding between manufacturers and central stations was resulting in great benefit. Orders in 1911 were 50-per-cent greater than those in 1910, and over 80 per cent of the orders were for additional equipment from those who had become acquainted with the advantages and economies of the electric vehicle. At present there are 20,000 commercial machines in operation and he prophesied that by 1915 there would be 200,000.

The speaker attributed the great increase in the use of electric vehicles to three things. (1) Manufacturers are realizing that profits are legitimate only when they come from service and they are backing up the vehicle throughout its life. (2) The public is ready to use some form of power vehicle and has found the electric vehicle reliable and superior to all other types for short-haul transportation. From data gathered in New York gasoline cars average 174 days of service in a year against 298 days for electric vehicles. Maintenance was also much less for the electric vehicle. Electrics had also shown their superiority in some of the recent blizzard weather. (3) The activities on the part of central stations in promoting the industry. Since the $100,000 advertising campaign of the Boston Edison company, many of the other cities are taking the matter up and giving it enthusiastic attention.

W. H. Daggett told of the electrical apparatus used in the Springfield Fire Department; that city being the first in the country to use such equipment. At the close of his remarks an exhibition of three pieces of electric-driven apparatus was given in front of the hotel.

On Thursday evening the members and guests were given an entertainment arranged by the Entertainment Committee, of which Walter L. Mulligan was chairman.

On Friday evening a very enjoyable banquet was held, after which the report of the Rate Committee was presented by L. R. Wallis, of the Edison Electric Illuminating Company, Boston. John F. Gilchrist, president of the National Association, then gave a very interesting address. He was followed by Frank M. Tait, first vice-president, and T. C. Martin, executive secretary.

Northwestern Electrical Show.

Exhibits at the Northwestern Electric Show, which was held in Minneapolis, Minn., March 16 to 23, were described in our last issue. A photograph showing a general view of the exhibits is reproduced herewith.

Each day during the show was named in honor of a prominent electrical inventor, who, on the day designated, sent a telegram to the people of the Twin Cities and the Northwest expressing a view of the progress of the electrical art. Each of these messages was received by a man prominent in the local community. The contents of these various telegrams is given below.

Fort Myers, Fla., March 16, 1912.
Governor A. O. Eberhart:

Congratulations upon the opening of the Northwestern Electrical Exposition of 1912. This is the age of electricity, with almost unlimited possibilities for the future. Every one should obtain a general idea of the capabilities and effects of this mysterious agent, for in time nearly all powers of nature will be utilized in the form of electricity. It will be the sole agent for the moving of all vehicles in cities, will displace the steam locomotives, and perform nearly every service on the farm and in the home, revolutionize the metallurgical and chemical industries and extract nitrogen from the air for soil fertilization. A twin sister to this exhibition, devoted to scientific farming, should be held annually in the great Northwest, illustrating methods for doubling the crops by the mere exercise of the intellect, bring about great and permanent prosperity and hastening the introduction of scientific apparatus, a large part of which is sure to be electrical.

Thomas A. Edison.

New York, N. Y., March 18, 1912.
His Grace, The Most Reverend Archbishop Ireland:

I bespeak your Grace's far-famed eloquence in voicing sentiments and ideas to which I can give but feeble expression. May the exposition prove a success befitting the cities of magical growth, the courage and energy of western enterprise, a credit to its organization, a lasting benefit to the communities and the world through its lessons and stimulating influence as a bewildering, unforgetable record of the triumphant progress of the art. Great as are the past achievements, the future holds out more glorious promise. We are getting an insight into the essence of things; our means and methods are being refined, a new and specialized race is developing with knowledge deep and precise, with greater powers and keener perceptions. Mysterious as ever before, nature yields her precious secrets more readily and the spirit of man asserts its mastery over the physical universe. The day is not distant when the very planet which gave him birth will tremble at the sound of his voice; he will make the sun his slave, harness the inexhaustible and terribly intense energy of microcosmic movement; cause atoms to combine in predetermined forms; he will draw the mighty ocean from its bed, transport it through the air and create lakes and rivers at will; he will command the wild elements; he will push on and on from great to greater deeds until with his intelligence and force he will reach out to spheres beyond the terrestrial.

I am your Grace's most obedient servant,

Nikola Tesla.

Pittsburgh, Pa., March 19, 1912.
President Edmund G. Fennington:

I send through you my greetings to the people of the Twin City and of the Northwest, whose achievements in the development and upbuilding of this country, are so fully recorded that nothing one person can say, can add to or detract from the record made. I desire to express the high appreciation I have for the designation of a Westinghouse day in my honor and especially if such honor is due to my work in connection with the safe op-

eration of railways and in the upbuilding of the electrical industry, the final results of which industry none of us can even now approximately foretell. I foresee for the future an electrical development which will lead to the universal use of electricity in our daily affairs, which will lighten our labors, increase our comfort, add to the productiveness of our soil and promote our health. The development of your waterpowers and other natural resources on conservative lines, under proper regulation, if encouraged and not hindered, will be of inestimable value not only to the people of the Northwest, but to all mankind. In concluding permit me to express the hope that the results of your exhibition will be all its energetic promoters could desire, and further to express my regret that I cannot be present with you today.

George Westinghouse.

Washington, D. C., March 20, 1912.
Mayor James C. Haynes:

Allow me through you to congratulate the people of the Twin City and the Northwest on the success of the great electrical exhibition at Minneapolis, which will undoubtedly prove a great stimulus to further advance in the application of electricity to the uses of man. We are only at the beginning of things in this respect and no one can safely predict what the future has in store. Already we obtain heat, sound, light and efficient motor power from this mysterious and unknown substance or force. We can cook our dinner by turning a switch. We can hear at a distance of a thousand miles. Our electric lights now rival the sun, and electric cars are carrying our people from place to place. What bounds can we set to the possibilities of electrical discovery and invention? The horizon constantly recedes as we advance and new territories come into view for exploration. Who could have predicted the possibility of seeing the bones of the human body through the living flesh by an electric ray or that this should have led to the discovery of radium and the whole field of radioactivity? One step leads to another and there is no end apparent to the line of advance. The electric magnet of Henry rendered possible the telegraph of Morse, which again developed into the telephone of today with its hundreds of thousands of miles of radiating wire. The next step has discarded the wire and we have wireless telegraphy and telephony with boundless possibilities of expansion. Where will the next step lead? We do not know, but as surely as the past foreshadows the future, new electrical discoveries will be made as startling and unforeseen as those of recent years.

Alexander Graham Bell.

Schenectady, N. Y., March 21, 1912.
Mayor Herbert P. Keller:

To the people of the Twin City and the Northwest, best greeting and congratulation to the successful electrical exposition. As rapidly as the conquest of the silent power which has entered the service of men during the last century has progressed heretofore, a still more rapid progress in the future is assured by the great and active interest which you and other progressive citizens take in the advance of science and industry. Before our century is passed we may have seen the last smoke-belching chimney disappearing from the habitations of man and the steam locomotive, the coal stove and the gas flame will be known to the coming generations only from the descriptions in the books of history and the exhibitions in historical museums; and when you convene at the exhibition in your progressive city I hope to send you my congratulations by word of mouth through the wireless telephone across empty space.

Charles P. Steinmetz.

Cleveland, O., March 22, 1912.
President George E. Vincent:

I heartily congratulate Minneapolis-Twin City on the success of her third annual electrical exposition. In little more than thirty years the electrical industries have grown from small beginnings to their present vast proportions, employing something like six thousand million dollars of capital in this country alone. The field for useful applications of electrical energy shows no sign of exhaustion and no man can foretell the future magnitude of its development. Electrical expositions such as yours are potent aids and spurs to progress in this direction and worthy of all encouragement and success.

Charles F. Brush.

West Lynn, Mass., March 23, 1912.
President Ludwig Kemper:

Twenty years ago I wrote an article on the future of electricity, which was published in the magazine, copy of which I have sent you. I had forgotten this article until a few days past when it turned up unexpectedly. If the future development of the electrical art exceeds in the same measure or to the same extent, the present growth as compared with what the boldest of us would have been willing to predict many years ago, then surely the importance which electrical work will have attained may not easily be exaggerated. Our predictions of so many years ago fell so far short of the reality that we are ourselves astonished. While celebrating these days, one of which you have honored me by calling Thomson Day, let us not forget to do honor to those still earlier pioneers, the best sample of which was Faraday, who did not live to see the enormous development in the science of electricity, for which their own work laid the most enduring foundation.

Sincere congratulations and best wishes for entire success of your celebration.

Elihu Thomson.

General View of Northwestern Electrical Show.

MINNESOTA ELECTRIC ASSOCIATION.

Fifth Annual Convention, Minneapolis, March 20-22.

The fifth annual convention of the Minnesota Electric Association was held in the Assembly Hall of the National Guard Armory, Minneapolis, Minn., March 20, 21 and 22. On account of the Northwestern Electric Show being held in the armory at the same time it was purposely arranged to give the visiting delegates sufficient opportunity to inspect the various exhibits and the program of papers was therefore comparatively light.

The first session was called to order shortly after 10 a. m. by President Kemper, and reports from the secretary-treasurer and various outstanding committees taken up. In the president's address, which was then delivered, Mr. Kemper referred particularly to public service commissions, to United States patent laws and the incandescent-lamp situation. Relative to commissions, it was pointed out that the present tendency in practically every state is for the state regulation of public-service corporations and in view of this it is incumbent upon central-station companies and associations of central stations to use their influence in having reasonable laws passed creating commissions which will deal honestly with the subject.

The patent-law situation was commented upon briefly and Mr. Kemper pointed out that while the recent decision of the United States Supreme Court was in accordance with existing laws, they should undoubtedly be revised and the Minnesota Association should join in the movement for a revision of these laws.

Regarding the incandescent-lamp situation Mr. Kemper expressed himself as being opposed to the new policies which the lamp companies are adopting. He said that due to various conditions, the small central stations so far have not deemed it a wise policy to push the sale of 25-watt lamps. Under the new conditions, however, the lamp companies will enter into contracts with any dealers, allowing them to act as agents without investment in a stock of lamps and giving them a larger commission on sales than has been obtained by central stations. He said that salesmen under the new conditions would come into a small town, find the central station under contract and then enter into a contract with the small storekeeper or contractor and demonstrate how they can make money by selling the 15 and 20-watt lamps by advancing the current-saving argument to central-station customers.

Following this address a Committee on Resolutions consisting of George Marvin, Thomas Pitts and Leonard Peterson was appointed and also a Nominating Committee consisting of T. C. Gordon, Herbert Markle and Alfred Horne.

The afternoon session was opened with a paper by Earl D. Jackson, of St. Paul, entitled "Oil and Other Internal-Combustion Engines." This paper discussed quite fully the characteristics of oil obtained from the fields in various localities. Engines using gasoline, naphtha, alcohol and crude oil were classified and a brief description given of the prominent types coming under each classification.

Leonard Peterson, of Thief River Falls, opened the discussion, calling attention to an installation of two 225-horsepower Diesel oil engines installed in his plant. One of these units was started about two weeks ago under full load and has given excellent satisfaction. Fuel costs 6.5 cents per gallon and tests have shown that 100 kilowatt-hours are produced at the switchboard with a fuel consumption of 10.5 gallons of oil. He mentioned, also, that the regulation is very good.

A. Wagner, of Huron, S. D., said that a gas-producer plant has been in operation in the Huron plant for over two years, and while the thermal efficiency was good, the plant must be given careful attention. Unlike steam plants, they cannot stand abuse.

Through the efforts of President Kemper, W. D'A. Ryan, illuminating engineer of the General Electric Company, was prevailed upon to deliver his lecture on "Lighting From the Early Ages to the Present Day." This lecture was identically the same as that presented by Mr. Ryan before the convention of the Minnesota Section of the American Institute of Electrical Engineers on Monday.

A paper by R. E. Brown, of Mankato, on the subject of "How to Increase Revenue In Small Towns" was then presented by the author. This paper, which described briefly the new-business methods of the Mankato Company, will be published in full in a later issue.

In the discussion which followed Mr. Brown's paper, results of maintaining 24-hour service in small towns were given. Thomas Pitts stated that 24-hour service has been maintained in his town for the past two years and the revenue per capita increased one-fifth over that obtained when lighting service only was furnished. A considerable portion of the day-load comprises domestic heating and cooking appliances.

E. Simmons, of Marshall, stated that 24-hour service has been established in Marshall for about four years. Two years ago the company installed a steam-heating system which has placed the property on a well paying basis. The central station is located about 290 feet from the center of distribution and a minimum expense was therefore incurred in installing the heating mains. The company has connected about 9,000 square feet of radiation. A flat-rate schedule of charging is maintained. In reply to question of E. T. Street as to trouble from leakages, Mr. Simmons stated that practically all equipment was purchased new two years ago and as yet no trouble has been encountered.

Mr. Rutledge, of Glenco, thought that considerable impetus will be given central-station steam heating and ice-making as revenue producers in the near future. A campaign for domestic appliances, he thought would also benefit central stations inaugurating day service.

Ludwig Kemper thought that steam heating on a flat-rate basis of charging is inadvisable in Minnesota due to the length of the heating season. He also stated that by adopting 24-hour service practically every central station can avail itself of a profitable motor load. In Albert Lea 450 kilowatts in motors are connected and this business is increasing at a rapid rate. The revenue per capita on all business is $8.00.

Mr. Beck, of the Minneapolis General Electric Company, spoke briefly regarding electric cooking. He thought that considerable development was necessary before electric ranges could be adopted in average homes. He made tests on one installation in Minneapolis where a five-cent rate was made; the monthly bills averaged from $9.00 to $12 for a family of three. He said that the demand ranges from 4.5 to 5 kilowatts, which is entirely too high.

Alfred Horne, of Fairmont, spoke briefly of the conditions in his town. Twenty-four-hour service has been maintained over five years, and during that time a connected load of 346 horsepower in motors has been acquired. The company has also placed in service 200 flat irons, a large number of fans and several washing machines, vacuum cleaners, etc. The company has also on its lines two refrigerating plants which employ 25 horsepower motors, which he considers excellent business for the small station. Regarding electric ranges, Mr. Horne stated that while the Fairmont Company has not succeeded in placing very many ranges every house wired is provided with a heating circuit so that a range can be installed if desired.

The session on Thursday morning was opened with the paper entitled "Mazda versus Gas, Gasoline and Arc Street Lighting" by William Cole and H. H. Magdsick. This paper was divided into two parts, the first dealing particularly with the street lighting installation of Warren, O.; the second part dealing with the cost and relative value of various competing illuminants. The paper was discussed briefly by R. B. Wallace and Norman Macbeth.

The paper stated that to deal intelligently with the field of the various units, their performance and cost, it is necessary to consider the subject of street lighting as it relates to the requirements in the various classes of streets. For this purpose a division may be made into:

First-class or chief streets, which com-

prise the main thoroughfares or highways of traffic as well as the principal business streets of a city;

Secondary streets, which include the greater part of the residential and outlying business districts and usually forms more than two-thirds of the total mileage to be illuminated;

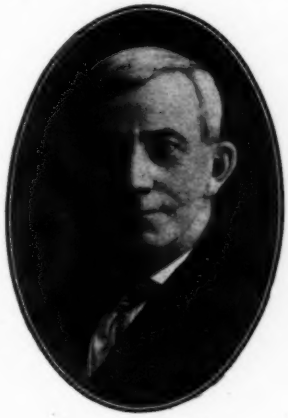
Third-class streets, which include out-lying residence districts and parks.

University Avenue in Minneapolis and St. Paul is representative of the first division of chief streets, the highways. Their illumination must be uniformly high so that automobiles and other rapidly moving vehicles may be driven with ease and safety and that objects and people may be readily recognized. Such streets are usually broad and not densely shaded. Under these conditions the large flux of light from high-efficiency arc lamps suspended over the center of the street or from mast arms can be utilized to the best advantage. Inasmuch as modern series arc lamps are inherently the most efficient light sources where their high intensity can be properly utilized, they form the most economical street illuminants wherever the density of traffic warrants the spacing of high-candlepower units at relatively short intervals. The incandescent lamp cannot compete successfully with the arc in this field if utility alone is considered.

At present the 6.6-ampere magnetite arc stands preeminent in the lighting of thoroughfares. The main highways of the city of Boston form excellent examples of the results which may be obtained with this lamp. One feature which contributes materially to the success of the Boston installation is the use of diffusing globes, which largely eliminate the blinding glare. The usual practice of equipping these units with clear globes cannot be too strongly condemned. The efficacy of a lighting installation is not measured merely in physical quantities; in street illumination the element of glare largely influences the results.

The latest development for this class of service are the long-burning flame arc lamps. While every detail of their construction and operation is, perhaps, not as yet fully perfected for street service, they will soon become an important factor in this work and, because of their inherently higher efficiency, eventually replace the luminous lamp wherever units of high candlepower are applicable. With the introduction of these high-intensity sources it becomes necessary to suspend the lamps at heights of thirty feet or more above the street in order to secure satisfactory distribution and to reduce the glare. This fact introduces certain practical complications. It has been found that cut-outs do not always work properly with lamps at such heights, and the use of trucks with ladders for trimming is out of the question; however, since high suspension is essential to the success of the flame lamp, this difficulty will undoubtedly be eliminated.

In the second division of chief streets, those in the main business sections of a town, a fairly high intensity of illumination is required, both from the standpoint of utility and for the purpose of attracting the people to the streets at night; however, the appearance of the installation both by day and by night is of equal importance. Furthermore, the lighting is reinforced by, and to some extent must be determined by the illumination of show windows, electric signs, and the various forms of outline and exterior lighting. These form a valuable advertising medium for the consumer and a desirable load for the central station; for the best results, they should not be subordinated to the decorative lighting of the streets. Ornamental lighting fails of its purpose if, after bringing the people out on the street, it does not allow the most effective display of the things that are offered the



George Marvin,
President Minnesota Electric Association.

public. It is a matter of common observation that where the brightness of the windows is well above that of the street, many more people stop to look at them at night than during the day, not alone because they have more time, but also because of the strong attraction of a conspicuously lighted display. If a blaze of light is provided on the street, the windows lose their prominence just as under daylight conditions, signs and distinctive lighting of buildings appear faint, and the stores and shops lose much of their individuality. To be sure, a high standard of illumination should be encouraged; nevertheless, there is a point beyond which the lighting should not be carried if permanent satisfaction is to be insured.

To make decorative lighting most effective, the central station which furnishes the current should make every effort to obtain uniformity in design either by city ordinance or through cooperative means. The deplorable results which follow when this policy is not pursued is exemplified in various parts of Chicago's "loop" district. In large cities the design may, however, well be varied in the different business centers. The use of lamps in the upright position has been criticized on the ground that when so placed they are 30 per cent less efficient than when hung pendant. It is true that this difference exists if we consider the total light flux which reaches the street surface; however, we are concerned more with the minimum value of illumination and the uniformity secured. Calculations show that with the standards as ordinarily installed, the minimum intensity with upright lamps is practically identical with that from pendant units and, since the maximum is less with the former arrangement, that upright lamps actually excel from the standpoint of uniformity; consequently, this position should be used whenever the appearance of the standard is thereby enhanced. The same considerations are favorable to the use of single-light standards, which have not been utilized as extensively as they deserve. In many cases the appearance could be materially improved and more of the light flux made useful by placing the lamps at a greater height. The installation on Michigan Boulevard in Chicago may be cited as an example of what can be accomplished by proper regard for artistic design and efficiency.

In the second classification, or secondary streets, the requirements differ from those discussed above. The streets are usually narrower, better shaded and have less traffic. The appropriation available for their lighting is so small that a uniformly high intensity of illumination cannot be attempted. However the standard of illumination for such streets is rising, and whereas a few years ago an arc lamp at each intersection or even at every second corner was usually considered sufficient, there is now a demand that the illumination be made more uniform and of a higher average intensity.

The blocks in such districts average somewhat more than 400 feet in length. To produce illumination at all satisfactory from the standpoint of uniformity requires that the corner arc lamp be suspended very high above the street, but under this condition much of the light will be cut off by the shade trees. On the other hand, in order to render the illumination most effective, glare should be eliminated so far as possible by keeping brilliant high-candlepower sources out of the line of vision. Likewise, the light should be steady. The ability to see at the low intensities provided depends largely upon the dark adaptation of the eye. If the lighting varies too greatly from point to point and if the eye is disturbed by bright sources, the ability to see will be greatly reduced.

These requirements favor the use of small incandescent units on the curb line. Even though the arc lamps are equipped with opal globes, the glare will still be much greater than from incandescent lamps because of the position of the arcs

over the middle of the street and their higher intensity. While the desired conditions are more nearly met as the size of the units is decreased, the number actually used must be governed by the cost of installation and operation as well as by such practical limitations as the spacing of existing pole lines. In practice it is found that 80- or 60-candlepower incandescent lamps are best suited to the purpose.

To determine the relative value of incandescent and arc lamps for this class of lighting, a comparison is made of the operating cost of 60-candlepower Mazda lamps with radially fluted reflectors with the cost of the modern arc that is most often employed in this field, the four-ampere magnetite lamp. From Table 1 it is apparent that five 60-candlepower Mazda lamps can be operated for about the same cost as one magnetite arc.

To compare the illumination results which may be obtained with the two equipments we may assume blocks 440 feet in length lighted by four-ampere lamps suspended 20 feet above the ground at each intersection. With this arrangement it would be unnecessary to provide additional illumination for the cross streets since the blocks are usually shorter in that direction and the lighting would therefore be superior to that upon the street for which the illumination is actually designed. The Mazda installation would, of course, have a lamp at each corner, but it would also become necessary to place a lamp in the middle of the block on cross streets in order that the illumination might not fall too low at that point. With this arrangement the alleys would also be lighted to a low intensity, whereas the arc lamp would leave them totally dark.

COMPARATIVE COSTS—MAGNETITE AND MAZDA LAMPS.

Unit	Magnetite Arc	Mazda Lamp
Watts at lamp terminals	810	71
Efficiency of distribution lines, per cent	92	92
Efficiency of transformers, per cent	....	96
Efficiency of transformer-rectifier sets, per cent	85	..
Watts at sub-station	396	80
Power-factor of circuit, per cent	67.5	87.5
First cost of lamps	$25.00	†$0.77
First cost of fixtures and sub-station equipment	30.00	6.50
*First cost, total	55.00	7.27
Annual Maintenance Cost, 4,000 Hours Service:		
Interest and Insurance, 6 per cent	$ 3.30	$0.44
Depreciation on permanent parts, 12.5 per cent	6.87	.81
Lamp renewals—3 at 77 cents	....	2.31
Labor for inspection or cleaning	.75	.60
Repairs for inspection or cleaning	2.00	.25
Electrodes, positive—1 at 60 cents	.60	.....
Electrodes, negative—23 at 5 cents	1.15	....
Globes—1 at $1.00	1.00	....
Rectifier tubes	3.00	....
Trimming—23 at 7.5 cents	1.72	....
Total	$20.39	$4.41
Energy, 4,000 Hours:		
1c. per kilowatt-hour at 87.5 per cent power-factor	.....	$3.20
1.1c. per kilowatt-hour at ‡67.5 per cent power-factor	$17.42	.....
Total Operating Cost, 4,000 Hours Per Year:		
Energy at 1c (at 87.5 per cent power-factor, 1.1c at 67.5 per cent power-factor)	$37.81	$ 7.61
Energy at 2c	55.23	10.81
Energy at 3c	77.65	14.01
Energy at 4c	90.07	17.21
Energy at 5c	107.49	20.41

*The first cost and maintenance of overhead construction is omitted from this table, as it would be practically identical for Mazda and arc installations.

†$1,200 Contract.

‡The higher cost of energy is due to the increased investment in generators, lines and apparatus and their decreased efficiency at the lower power-factor. The fixed charges on this investment form a large part of the cost of energy.

The paper on "A System of Accounting for Central Stations" was then presented by Charles G. Edwards, of Albert Lea. This paper, which dealt with the particular system of accounting adopted in Albert Lea and which may offer suggestions to small central-station companies, will be published complete in a later issue.

The afternoon session on Thursday was devoted to the inspection of the new generating and substations of the Minneapolis General Electric Company. The delegates met at the West Hotel and were conveyed by automobile to the various stations.

Friday morning was devoted to a discussion of the president's address, particularly that section dealing with the affairs of the Minnesota Electric Association. A very interesting lecture on "Competitive Illuminants" was then delivered by Norman Macbeth. Mr. Macbeth illustrated numerous typical gas and electric installations, suggesting methods for improvement where possible. In his address he pointed out that the central-station man should ignore the question of cost and confine his argument to the merits of electricity, as it is bad practice, he thought, to antagonize the gas man.

The discussion was opened by H. J. Gille, Minneapolis, who thought that gas for illumination was losing in favor and central stations were encountering less competition in lighting than heretofore.

F. A. Otto, of the St. Paul Gas Light Company, thought that good salesmanship on the part of central-station men and good service as regards electric lighting is sufficient to eliminate the competition of gas for lighting purposes.

E. L. Callahan, of Chicago, thought that gas is not a competitor of electricity for illumination and new-business men of the Byllesby properties are so instructed. There is competition, however, with gasoline lighting with certain classes of customers where the great difference in cost is the main consideration.

A session was necessary on Friday afternoon to complete the program. A paper by S. H. Conkey, of Minneapolis, entitled "Electric Vehicles" was first taken up. This paper will be published in a later issue. A brief discussion was entered into by E. T. Street, E. A. Aspnes and Mr. Conkey.

Mr. Street read a report compiled in Chicago on the cost of operating electric vehicles. In reply to a question of Mr. Aspnes as to comparative costs between electric vehicles and horse-drawn vehicles Mr. Conkey said that conditions in different cities vary to such an extent that comparative figures must necessarily be obtained in each case. General figures, however, indicate a considerable saving where electric vehicles are used.

The report of the Nominating Committee was then presented as follows:

President, George Marvin, St. Cloud.

First vice-president, Leonard Peterson, Thief River Falls.

Second vice-president, W. J. Buchan, Worthington.

Secretary-treasurer, E. F. Strong, Chaska.

For the Executive Committee, Eugene Holcomb, St. Paul; Ludwig Kemper, Albert Lea; R. C. Brown, Mankato. The new president and secretary are also members of this Committee. The secretary was instructed to cast the ballot of the Association for the slate proposed.

Before adjournment President Kemper proposed the following resolution which was unanimously adopted:

"Be it resolved that the Minnesota Electric Association disapproves of the present method of marketing patented electric incandescent lamps for the reason that this method discriminates in price in favor of the dealer and opens the way to certain practices in retailing these lamps which are injurious to the best interests of both the central station and its customers."

Accident to Electrical Men.

On March 13, W. H. Thomson, Jr., general manager of the Des Moines Electric Company, George Peters, C. W. Place, of General Electric Company, and a chauffeur, met with a serious accident when a Rock Island switch engine ran into their automobile and knocked two of the occupants in the river, causing serious but not fatal injuries. Mr. Thomson had a hip dislocated and hand mashed. He will be out of the hospital in about four weeks. Mr. Peters, his superintendent, was injured so that amputation of one foot above the ankle was necessary. Mr. Place was taken to the hospital, where minor injuries were attended to.

MINNESOTA SECTION A. I. E. E.

Annual Convention, Minneapolis, March 18-19.

The annual convention of the Minnesota Section, American Institute f Electrical Engineers, was held in Minneapolis, Minn., March 18 and 19. This was one of the three electrical meetings held during the week of the Northwestern Electric Show and many Minnesota and visiting members were drawn to Minneapolis by the exposition.

Sessions were held Monday and Tuesday afternoons in the assembly hall of the National Guard Armory, and Tuesday night the convention was brought to a close with a banquet and business meeting at the Radisson Hotel.

The session on Monday was called to order at 2 p. m. by Charles L. Pillsbury, chairman of the Section. Owing to unforeseen conditions it was necessary to change the order of papers, an illustrated lecture by M. R. Hutchison on "The Edison Storage Battery" being taken up first. The construction of the Edison battery was explained and slides shown illustrating the various parts. A number of performance curves were shown and also various curves of tests under normal and abnormal conditions. One interesting test described was that wherein a type A-4 Edison cell, weighing 13.5 pounds, was lifted and dropped one-half inch on solid wood 1,776,000 times. Curves showed that the capacity of the cell was not diminished. Other interesting curves showed cells to have the same capacity after charge, at the end of six months' standing totally idle and neglected, as at the beginning of the six months. The results of many other tests of a similar nature were shown.

The session was closed with an interesting paper by A. L. Ablott on the subject of "The Work of the Illuminating Engineer."

A paper by W. R. Patton, of the Wagner Electric Manufacturing Company, on the "Unity-Power-Factor Motor" was the opening one at the session on Tuesday afternoon. Mr. Patton spoke first of the general characteristics of single-phase motors and gave several reasons for a wider use of single phase in power transmission. A complete description of the new unity-power-factor motor, as developed by the Wagner company, was then given. This motor was described rather fully in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for October, 21, 1911. "Lighting from the Early Ages to the Present Time" was the subject of an interesting lecture delivered by W. D'A. Ryan, following Mr. Patton's paper. A great many slides were shown picturing the development of lighting units from the crude lamps of early days to the present high-candlepower units. Corresponding developments in generating machines were also illustrated. Mr. Ryan also showed views of numerous street lighting and interior installations and curves and charts for obtaining comparisons.

The concluding paper of the session was by E. H. Scofield, of Minneapolis, entitled "Central Station Graphical Records." Mr. Scofield, who is chief engineer of Twin City Railway Company, presented complete power and cost records of the company's generating stations and explained how each is kept. Records and charts concerning car operation, etc., were also shown.

A session was held on Tuesday evening in the Empire Room of the Radisson Hotel, preceded by a banquet. The first speaker was Francis C. Shenehon, of the University of Minnesota, who addressed the meeting on the subject of "The Relation Between the Hydroelectric Development of Niagara Falls and Its Scenic Value."

Mr. Shenehon has made a careful study of the conditions at Niagara Falls both from the standpoint of Government expert, retained to advise as to the effect of hydroelectric development on the scenic grandeur of the Falls, and as consulting engineer for the power companies located there. The flow available is 200,000 cubic feet of water per second, which with the head of 330 feet would develop 7,500,000 theoretical horsepower. Of the 200,000 cubic feet per second, the power companies located at the Falls are at present allowed under the Burton Act 58,000 cubic feet per second. This does not include the 10,000 cubic feet drawn in the Sanitary Canal at Chicago, or at Sault Ste. Marie and various canals. Altogether one-third of the total amount of water possible to pass through the cataract is utilized, which, in the opinion of Mr. Shenehon, should be the maximum allowed. In closing, he stated that personally he felt that no more should be taken until the poverty of the country demands it.

Ralph W. Pope, honorary secretary of the American Institute of Electrical Engineers, was the next speaker. The subject chosen by Mr. Pope was the "Magnetic Testing of Steel Rails for Determining Defects in Manufacture." In his introductory remarks the speaker referred to a clause in the American Institute Code of Ethics relative to the duty of engineers in promoting safety for the public. In this connection he thought that safety in railroad travel is of greatest importance and affects the public to a greater extent than any other engineering work. Mr. Pope explained that when visiting the Bureau of Standards at Washington, recently, he found that, while some advancement had been made toward the magnetic testing of rails, the Bureau necessarily had to neglect the work on account of lack of funds for that purpose. Therefore he thought that the Institute could not better carry out the spirit of the Code of Ethics than to use its influence in having the Bureau carry on this important work and devise a means for commercially testing rails.

A brief discussion was entered into by Messrs. Burch, Ryan and Cavanaugh. Mr. Burch said that it is doubtful if rail testing could remedy present conditions. Railroads demand cheap rails, which menas high-carbon steel, and the traveling public demands speed, necessitating heavy locomotives. Under these conditions broken rails and accidents are inevitable.

Professor Ryan thought that it was important for the Bureau of Standards to continue its work on rail testing. It is first necessary to develop a satisfactory device for measuring permeability, which he thought could easily be accomplished.

F. A. Otto, of the St. Paul Gas Light Company, was the next speaker, his subject being "The Flame Arc Lamp as Adopted by the St. Paul Gas Light Company." Mr. Otto briefly described the new street-lighting installation in St. Paul, which at present consists of 200 series alternating-current lamps and 100 multiple direct-current lamps. The installation has given satisfaction, although at first considerable trouble was experienced. Numerous curves showing costs and results being obtained were exhibited.

Mr. McGrath, of Minneapolis, was called upon to explain the Minneapolis system. Magnetite lamps, of 6.6-ampere size are employed, using clear globes. About 1,700 are in service and the results being obtained are entirely satisfactory.

Truman Hibbard, of the Electric Machinery Company, then delivered a very interesting address dealing with the relation of the University of Minnesota alumni to the public. He pointed out that the engineering graduate of a state institution owes a duty to the public and should devote a portion of his time to public service.

A paper by F. G. Dustin on the "New Electrical Ordinance for Minneapolis" was the concluding feature of the program. This paper, which discussed the relationship between the electrical contractor and the city inspector, will be published in a subsequent issue of this journal.

New Electrical and Mechanical Appliances

Automatic Control for a Motor-Driven Crank Shaper.

The machine illustrated herewith is a 24-inch Gould & Eberhardt crank shaper driven by a 5-horsepower Reliance adjustable-speed motor of the armature-shifting type with a speed range of 300 to 1,500 revolutions per minute. It is equipped with automatic starting control and Reliance speed dial.

Speed adjustments with the Reliance adjustable-speed motor are obtained by the mechanical shifting of the motor armature. This is controlled by the handwheel *A* on the equipment illustrated. Turning this wheel causes quick but smooth changes in the cutting speed.

With the speed properly set for a given operation the motor may be stopped and started as often as desired without further attention to the speed adjustment. This is possible with this type of motor because the starting and stopping is entirely separate from the speed control.

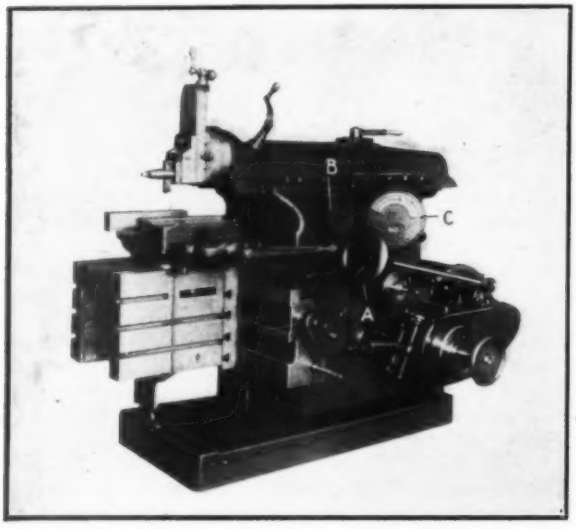
By using a motor with a speed range equal to the ratio of the back gear an unbroken range of cutting strokes is obtained from 4.5 to 115. The unlimited number of cutting strokes throughout this wide range combined with ample power at all speeds insures maximum output for any size cut.

The starting and stopping of the motor are controlled by an automatic starter through the drum switch *B*. This switch has three points, "start," "off," and "brake." To start the motor it is simply necessary for the operator to throw the switch to the starting position. When the switch is thrown to the "off" position the power is shut off and the time taken for the machine to stop will depend upon the time required for friction to overcome the momentum of the moving parts.

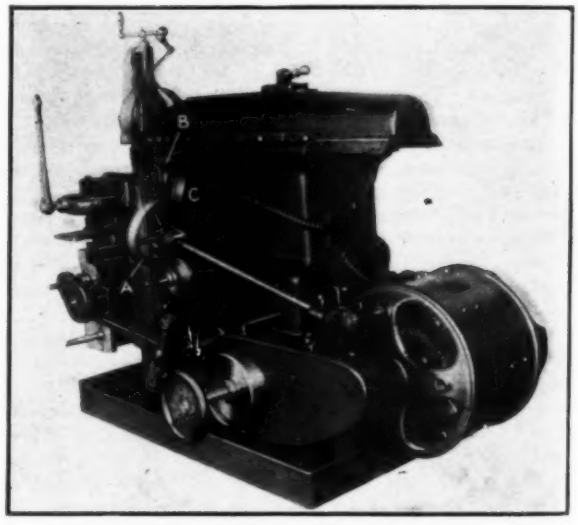
When the switch is thrown to the brake position the motor is automatically brought to a stop almost instantly. This simple and positive method of stopping eliminates the necessity of a clutch, which it will be noted is not used on the shaper illustrated. With this method the motor is never running idle nor unnecessarily wasting power.

The starter is of the series control type and automatically takes care of all starting conditions. It removes all possibility of abuse to the motor or starting equipment. The starter itself is mounted on a nearby post. All wires are carried in conduit tapped directly into the drum switch, thus doing away entirely with exposed wiring and contacts about the machine.

As shown at *C*, this machine is also equipped with the Reliance speed dial, which was described in these columns in the issue of March 16. This device, the motor and the control equipment, were manufactured by the Reliance Electric & Engineering Company, of Cleveland, Ohio.



Shaper Equipped With Automatic Motor Control.



Motor and Wiring of Shaper.

The Portable Telephone Set as a Railroad Time Saver.

Wearying of the continued loss of time entailed by the inability of crews of stalled trains and of repair gangs to communicate with headquarters from places along the right of way, the Lehigh Valley Railroad has purchased in all over 700 Western Electric Company portable telephone sets during the past year. Each train unit is furnished with one of these sets, as is each bridge crew and each track-repair gang. The officials of the road state without reservation that the purchase of these sets is one of the most profitable investments the company has ever made. They have more than paid for themselves.

One of the track-repair gangs was sent out recently with its first portable set. The gang consisted of 40 men, whose business it was to replace worn rails. The "Black Diamond" express, one of the leading trains of the Lehigh Valley, was due, according to schedule, just about the time the track foreman was ready to replace several rails. Under the old order of things, the fore-

man would have waited until the "Black Diamond," which had the right of way, had passed before beginning work. Having a portable set at his command, he communicated with headquarters and learned that the train was two hours late on account of a snow slide. Knowing this, the foreman went ahead with his work, made the rail replacement and had ample time to move to the next place of operation before the train appeared.

It does not take long for many incidents of this character, numbers of which occur every day, to make the telephone more than pay for itself in enabling the track gang to work to the highest possible efficiency. The bridge inspector can report minor troubles to headquarters and have a repair gang start toward the scene of action in less time than he could formerly reach a signal tower. In an emergency, such as a wreck, the train crew can communicate with the dispatcher and give detailed information concerning the extent of the accident. The railroad officials can then arrange with a minimum of delay for the rerouting of trains and the hurrying of wrecking and relief trains to the scene.

Great Copper Production.

The copper mines of the United States have produced more than fifteen billion pounds of copper, and of this total twelve mining districts have produced in excess of 100,000,000 pounds each, according to the United States Geological Survey. These twelve districts, located in eight states, have yielded 94.69 per cent of the total output of the country since 1845, when the total product of the United States was but little more than 200,000 pounds. These districts are Butte, Mont., which has yielded 5,315,000,000 pounds, or 34.73 per cent of the total production; Lake Superior, Mich., which has yielded 4,756,000,000 pounds; Bisbee, Ariz., 1,285,000,000 pounds; Morenci-Metcalf, Ariz., 882,700,000 pounds; Jerome, Ariz., 570,000,000 pounds; Bingham, Utah, 465,000,000 pounds; Shasta County, Cal., 336,000,000 pounds; Globe, Ariz., 334,700,000 pounds; Ducktown, Tenn., 211,700,000; Ely, Neb., 125,000,000 pounds; the foothill belt, California, 104,000,000 pounds; and Santa Rita, N. Mex. (where mining is believed to have been begun as far back as 1800), 103,000,000 pounds.

The first ten of these districts are also the first ten largest producers today, although the order is slightly changed. These ten districts yielded 93.84 per cent of the production for 1910. The United States is by far the greatest copper-producing country, our smelter output of copper in 1910 being 56.75 per cent of the world's total.

The Federal Portable Power Table.

That the use of the electric motor could be greatly extended in the home, if it were not necessary to have a separate motor for each appliance, has been appreciated by many central-station men. To meet this demand a portable power table has been placed on the market by the Federal Sign System (Electric), of Chicago.

As shown in the accompanying illustration, it consists of a compact and well built oak table 30 inches high with an 18 by 26 inch top. On the lower shelf is a one-fourth horsepower motor mounted on a base integral with a gear case. It drives a vertical shaft through bevel gears and this in turn drives two short horizontal shafts mounted in the power head on top of the table. In the table top is a groove or slot in which a great variety of attachments can be inserted and firmly locked by moving the lever at the front edge of the table. These appliances couple conveniently to the end of either of the horizontal shafts, depending on the height best suited to the work. There is also provided an extension of the lower shaft with a pulley to permit driving external or bulky machines. This can also be done directly from a small pulley on the motor shaft.

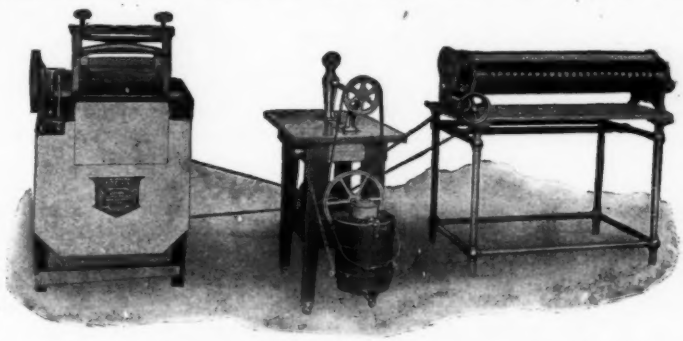
Use of Power Table in Kitchen.

Use of Power Table in Shop.

The illustrations show the utility of the power table for a number of household uses. One of them shows how a number of appliances can be driven at one time. Among the special appliances already designed for use with the power table are the following: bread mixer, cake mixer, coffee grinder, meat chopper, ice-cream freezer, egg beater, vegetable slicer, food grater, apple pealer, knife sharpener and knife polisher.

Although the Federal power table was designed particularly for general domestic use, it is well adapted for small workshops or laboratories where power is frequently desirable for driving various tools or devices.

The table is mounted on castors to make it readily portable. Its top has a smooth nickeloid surface that is practically non-corrodible. The gears and couplings are thoroughly protected and the motor itself is well out of the way so as to prevent anything catching in moving parts.



Power Table Driving Washer, Mangle and Ice-Cream Freezer.

A New Oil Switch for Industrial Applications.

Those who are interested in the applications of electricity in industrial plants, such as powder works, coal mines, cement mills, gas works, textile mills and the like, especially where explosive gases or flying inflammable materials are present, will welcome the introduction of a new oil switch which can be used satisfactorily in such locations and under these conditions.

Before designing this switch the conditions of operation in the places enumerated above and the difficulties to be overcome were carefully canvassed with the result that the following qualities were incorporated in the design:

First, safety by having all live parts entirely inclosed.

Second, reliability by constructing the switch so that it can be operated by unskilled operators.

Third, durability by having the best of mechanical construction.

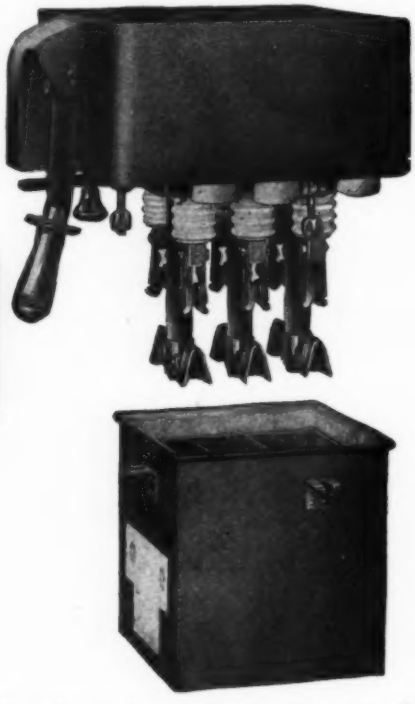
Fourth, flexibility by a combination of features adapting it to a wide range of requirements.

This switch is manufactured double and triple pole in capacities up to 300 amperes and 2,500 volts, both non-automatic and automatic. The automatic switches are tripped by overload coils connected in series with the line and can be furnished in the following combinations: with overload trip coils, instantaneous or time limit, with low-voltage release attachment; with similar overload trip coils, but without low-voltage release; with low voltage release only.

Automatic Oil Switch With Overload and No-Voltage Release.

The switch leads are usually brought out through the sides and bottom of the switch frame but if it is necessary to bring them out at the top, special covers can be provided. These are made in two pieces, one removable to secure access to the interior of the switch without disturbing the wiring, and the other supplied with holes for the leads. Covers can be furnished with porcelain bushings for open wiring; with holes for conduit wiring; or with holes for bell mouths to take triple-conductor cable.

These switches can also be supplied with special covers for mounting a series ammeter on top of the switch, to make, in effect, a complete induction-motor control outfit, thus dispensing with the usual panel and supports. The covers are also made in two parts. The front half carries a bracket for mounting the ammeter, while the rear half is removable to facilitate making connections to the switch and from the switch to the ammeter. The latter is a useful adjunct to the oil switch, as it indicates at all times the current taken by the motor and can be used to detect faults in the motor circuit, thus permitting immediate corrections of minor troubles which might otherwise cause a shutdown.



Non-Automatic Oil Switch With Oil Tank Lowered.

These switches are practically dust-proof for ordinary conditions. However, when used in cement mills, etc., extra precautions must be taken to exclude dust, and special gaskets can be furnished which will accomplish this purpose.

An interlock can also be supplied so that when the switch is used with induction motors employing resistance for starting or varying the speed the switch cannot be closed unless the resistance is in the "off" position.

In installations where a large number of induction-motors are used it is sometimes desirable to install a locking device in connection with the oil switch so that an operator can shut down the motor to work on a machine and lock the switch. No other person can then start the motor accidentally or otherwise, until the first operator, who holds the locking key, is ready and returns the key. An arrangement to accomplish this can be furnished, which consists of a magnetic lock in connection with the low-voltage release and a special snap switch with removable key. Special indicating lamps are also used which are lighted when the oil switch is locked and the key removed from the snap switch.

These switches are known as the type F, form K-20 oil switches and are made by the General Electric Company, Schenectady N. Y.

New Pass & Seymour Sockets.

Among the great variety of electrical specialties that are continually being developed by Pass & Seymour, Incorporated, of Solvay, N. Y., are two new sockets, illustrated herewith. No. 241 is a keyless porcelain socket with an interchangeable body part and a half-inch aluminum cap; this is specially designed for lighting of metal ceilings. No. 434 is a porcelain key socket with an interchangeable body and a one-fourth-inch brass cap; polished brass is the standard finish, but brush-brass finish may be had at the same rates.

New Pass & Seymour Sockets Nos. 241 and 434.

Telephone Train Dispatching.

The Chesapeake & Ohio Railroad Company has put in operation a telephone system for dispatching trains, as an auxiliary to the telegraph instruments.

Westinghouse Overspeed Limit Device.

A new overspeed limit device for rotary converters and motor-generator sets has been developed and will be furnished on all Westinghouse rotary converters built in the furture, and, when especially ordered, on motor-generators. Fig. 1 shows the application of the new device to the end of a rotary-converter shaft and Fig. 2 illustrates the details. Among the advantageous features of the new device are its positive action, few parts, rugged construction and compactness.

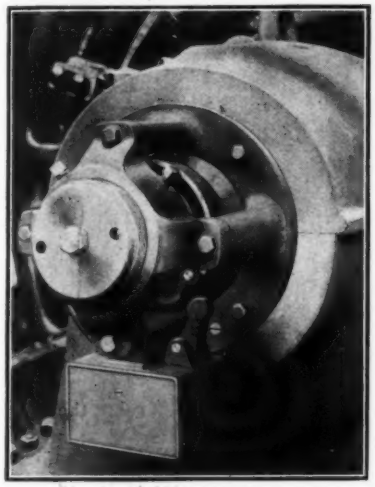


Fig. 1.—Overspeed Limit Device.

Normally the trip lever is held in the position shown in full lines by the trip spring, Fig. 2. If the speed of the machine exceeds the value (usually 15 per cent overspeed) for which the device is set, the trip lever, due to its centrifugal force, flies outward positively and quickly, and, knocking over the switch arm, closes the switch. An important point in connection with its action is its positiveness. If the trip lever starts to fly out, the speed remaining constant or increasing, it will continue until it strikes the stop. This action is due to the proportions and disposition of the trip spring and the trip lever. The point on the trip lever that strikes the switch arm is approximately at the center of percussion of the lever, a fact that insures an effective blow being struck by the lever.

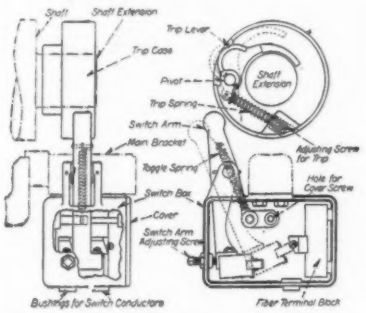


Fig. 2.—Detail of Mechanism.

Normally the switch arm is held in the open position by a toggle spring. The relation of the spring to the lever is such that the resisting torque of the spring is a minimum. When the trip lever strikes the switch arm it forces the arm past the center point of the toggle mechanism and the switch, under the spring's tension, closes of itself.

It is only necessary for the trip lever to move the arm a small distance, possibly three thirty-seconds of an inch, to insure that the switch will close. The relation of the parts is such that, when the arm is in the closed position, the contacts are forced against the contact blocks with considerable pressure—much more pressure than is required to trip the switch.

To reset the switch it is merely necessary to move the switch arm back to the normal position by hand. This can be readily done at any time whether the machine is running or not and without opening the switch box.

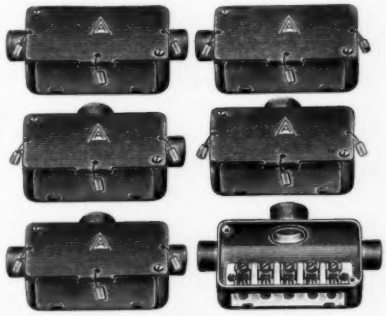
That very few parts are involved is evident from an inspection of the illustrations. The minimum diameter for any bearing pin is one-half inch, and the other parts are correspondingly strong. Adjusting screws are provided whereby the position of the trip lever can be closely regulated so that it will act at the predetermined speed. The sensitiveness of action of the switch arm can also be regulated by an adjusting screw.

Electrical connections for the new device will be the same as those used for the former Westinghouse standard overspeed trip arrangement. If the converter attains an overspeed, the trip lever flies out, the switch arm forces its contacts against the contact blocks and an auxiliary circuit is closed. With the usual scheme of connections, the closing of this circuit energizes the solenoid of a tripping device on the alternating-current circuit-breakers, which operates and opens the breakers, cutting the machine from its source of supply.

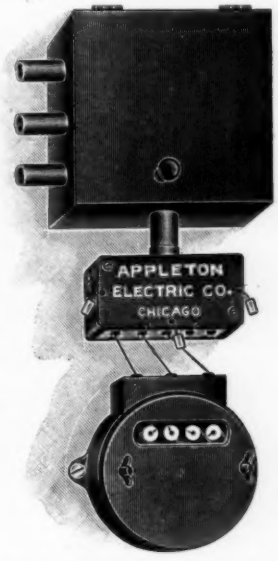
In addition to the overspeed limit switch illustrated, which must be reset manually, another switch has been developed which can be reset by a solenoid arranged within the switch box. A circuit extends from the solenoid to the switchboard and the equipment is so designed that, after the switch has been tripped, it can be reset by closing the solenoid circuit with a contact button located at the switchboard or any other convenient point.

Appleton Sealed Meter-Connecting Boxes.

The Appleton Electric Company, of Chicago, is placing on the market a new stamped steel box which acts as a medium between the cabinet box and the watt-hour meter. In a great many cities there has been for some time cause for considerable wrangling between the electrical contractors and the lighting companies in deciding just where each should commence and finish its particular part of the work, and consequently certain boards of fire underwriters have now ruled that boxes such as are shown here be installed, thereby eliminating hereafter any cause for discussion, and at the same time furnishing the lighting company with protection from theft of current in the form of a box that can be sealed.



Appleton Meter-Connecting Boxes.



Use of Appleton Meter Box.

Inside of each box is a porcelain block, upon which are mounted five brass terminals. The feed wires enter the box through the conduit, and on the opposite side of block are five holes large enough to pass No. 10 wire which leads to the meter. This side of the

box is closed by a steel plate and sealed until such time as the lighting company wishes to connect the service. These boxes are equipped so that the contractor can attach his wires to one end of the terminal, and when the lighting company is ready it attaches its wires to the opposite end of the terminals and then connects with the meter.

The boxes are also designed so that the cover, as well as the steel plate on the side of the box, can be sealed, thereby furnishing protection to the lighting company from any one tampering with a connection. These boxes are made up in several types and sizes so as to meet the demand under all conditions.

Transformers for Chicago Street Lighting.

One of the most important street-lighting undertakings in this country is that embraced in the new plans for lighting the streets of Chicago and the most modern type of equipment is being installed. Power will be supplied from the Sanitary District power house located at Lockport, Ill. Power is transmitted over a 44,000-volt, three-phase, 60-cycle line to the main terminal station in Chicago and stepped down to 12,000 volts, at which potential it is transmitted to the substations located in various parts of the city.

The type of transformer employed in substations is shown in the accompanying illustration, a total of 28 being supplied by the Delta-Star Electric Company, of Chicago, general western agents for the Pittsburgh Transformer Company. Each transformer has a capacity of 250 kilowatts, and is of the oil-cooled type, having a primary of 12,000 volts with taps at 11,500, 11,000 and 10,500; the secondary having a normal voltage of 5,050 with taps at 4,650 and 4,250. The efficiences come well within modern requirements, being 98.5 per cent at full load, 98.3 per cent at half load and 97.5 per cent at one-quarter load. The temperature rise is 35 degrees at full-load operation for 24 hours, and is less than 40 degrees after two hours at 125-per cent load immediately following the full-load run. The design is also such that the transformers will withstand a 200-per cent load for two hours without injury.

The transformers are of the standard Pittsburgh mill-type construction, employing thermo-vacuum impregnated coils with adequate spacings between high and low tension. The insulation between primary and secondary windings and between primary winding and core withstands a breakdown test of 34,100 volts; the insulation between secondary windings and core withstands a test of 12,000 volts.

The design is such that a comparatively high reactance is secured, which is desirable in limiting the amount of current rush under short-circuit conditions, a most desirable feature which is now generally recognized by operating engineers.

The tanks are of the welded type, the welding being carried out in every detail, in mounting the thermometers, valve and oil-gauge outlets, etc., thus insuring an absolutely oil-tight structure The leads are provided with metal unions for making connections to insulated copper tubing, thus permitting a neat and workmanlike installation.

Pittsburgh Transformers in Lighting Substation.

Sangamo Induction-Type Watt-Hour Meter.

The Sangamo Electric Company, Springfield, Ill., has announced its new self-contained single-phase type H induction meter in capacities from 30 to 100 amperes inclusive, a view of the glass-case type being shown in Fig. 1. The distinctive features of this meter are the extremely small number of parts and the ease of adjustment. It is claimed that the meter can be entirely taken apart and reassembled in 20 minutes, without disturbing the calibration.

Fig. 1.—Sangamo Self-Contained Meter.

The electrical characteristics can best be understood by referring to the curves of Fig. 2, from which it will be seen that in gaining mechanical simplicity the electrical operation has not been sacrificed. In addition to the micrometer adjustments, dust-proof features and large dials of the smaller-capacity type "H" meters, the larger-capacity meters are provided with a steel tube located in the connection box, through which passes one of the holding screws, thus preventing tampering by unauthorized persons.

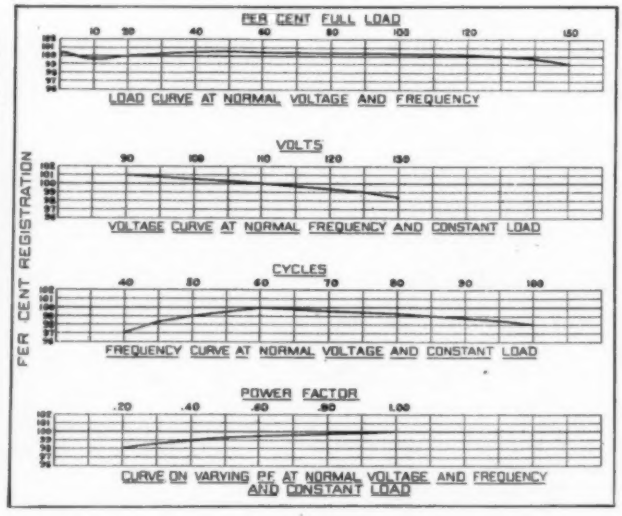

PER CENT FULL LOAD
LOAD CURVE AT NORMAL VOLTAGE AND FREQUENCY
VOLTS
VOLTAGE CURVE AT NORMAL FREQUENCY AND CONSTANT LOAD
CYCLES
FREQUENCY CURVE AT NORMAL VOLTAGE AND CONSTANT LOAD
POWER FACTOR
CURVE ON VARYING PF AT NORMAL VOLTAGE AND FREQUENCY AND CONSTANT LOAD
PER CENT REGISTRATION

Fig. 2.—Characteristic Curves of Sangamo Meter.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

LOTT, TEX.—The Lott Electric Company will rebuild its electric light plant.

CORSICA, S. D.—Local capitalists have purchased a site and will install an electric light plant. C.

WESTFIELD, IND.—Preparations are being made here to erect a new lighting plant.

HEDRICK, IOWA.—J. O. Ruggles will build an electric light and power plant here this spring. C.

NAPA, CAL.—The Great Western Power Company has been granted a franchise in this city.

FORTVILLE, IND.—The citizens of Fortville have under consideration the erection of a municipal lighting plant.

VIDALIA, GA.—The City contemplates the extension of its electric light system. Address the Mayor.

ST. LOUIS, MO.—The Dorris Motor Company will erect a one-story power house at a cost of over $7,000.

MEIGS, GA.—A bond issue of $20,000 has been authorized for municipal electric light and waterworks plants.

ANSON, TEX.—The Anson Water & Light Company has been incorporated with a capital stock of $10,000.

ROSEAU, MINN.—S. F. Banaime and others were awarded the franchise to build and maintain an electric light plant here. C.

SHELTON, NEB.—The Shelton Light & Power Company has been incorporated with a capital stock of $20,000.

ELK CITY, OKLA.—The Elk City Light & Power Company has been incorporated with a capital stock of $30,000.

HATTON, N. D.—The proposition carried to issue bonds for the erection of a municipal electric light and power plant. C.

CHISAGO CITY, MINN.—It is rumored that the General Electric Company will extend the electric service to this place. C.

LONGMONT, COLO.—The City of Longmont is making preparations for the erection of a municipal lighting plant.

SEATTLE, WASH.—W. J. Haycox and associates have been granted a 20-year franchise for a hydroelectric power plant.

CHIPLEY, GA.—The City has retained J. B. McCrary Company, Atlanta, as engineer to install an electric light plant.

FALLON, MO.—The City has issued bonds to the amount of $15,000 for the construction of an electric light plant.

EAGLE LAKE, TEX.—The Eagle Lake Water & Light Company has been incorporated by George Herder and others.

VILLE PLATTE, LA.—L. J. Dossmann, Opelousas, La., has been granted a franchise to construct an electric light system.

DAYTONA BEACH, FLA.—Schantz Electric, Ice & Water Company has secured a franchise to construct an electric light plant.

LEAD, S. D.—The council has decided upon cluster lighting for the business streets. There will be 136 of these of 50 candlepower each.

TYLERTOWN, MISS.—J. C. Flippen and C. H. Stephens have been granted a franchise to construct an electric light system.

McGEHEE, ARK.—The Missouri Valley Engineering Company of Mitchell, S. D., is preparing plans for an electric light and water works plant. C.

FORT SCOTT, KANS.—The Fort Scott Citizens Mutual Electric Company has been incorporated to install an electric light plant.

OCILLA, GA.—The City has retained J. B. McCrary Company, of Atlanta, to superintend the installation of a lighting plant.

REMSEN, IOWA.—Mathew R. Faber has been granted a franchise to build a lighting plant to cost about $14,000. Work will soon be started. C.

NAPOLEON, O.—Plans for better illumination of the business section of this city have been adopted. Clusters of tungsten lamps will be used. H.

LYNN, MASS.—The Merchants' Association proposes to raise a fund of $10,000 for the installation of an ornamental lighting system in Lynn.

SHELDON, IOWA.—M. F. Logan will be granted a franchise to build and maintain an electric light and power plant. C.

EL SEGUNDO, CAL.—The Southern California Edison Company has purchased lots here and work will commence very soon on its new plant.

CENTRALIA, WASH. — The Washington-Oregon Corporation is preparing to extend its Kalama power line from Kelso to Centralia and Chehalis.

McALESTER, OKLA.—A committee composed of Ben Durfee, Clyde Stewart, Arthur Krone and J B. McAlester has in charge the matter of a "White Way" for McAlester.

NEWBERN, GA.—The City has retained Dysard Construction Company, of Atlanta, to superintend the construction of a lighting system, which is estimated to cost $10,000.

WALLA WALLA, WASH.—The Walla Walla River Power Company has been organized and will endeavor to secure the water rights of the Walla Walla River, in which event they will develop over 2,000 horsepower and furnish power for manufacturing purposes in this city.

SACRAMENTO, CAL.—Articles of incorporation have been filed for the San Francisco-Oakland Terminal Power Company, capitalized at $30,000,000. The directors are F. O. Harrington, L. L. Dunne, Lloyd L. Jackson, L. Abbott, Nat Schmulowitz and C. Cosner, all of San Francisco.

GRAVITY, IOWA.—The Lee Electric Company has been granted a 25-year franchise for an electric light, heat and power system. This company has also been given a 10-year contract for street lighting. Current will be taken from its transmission line, which at present passes one mile from the town.

MORGAN CITY, UTAH.—Como Light & Power Company has filed articles of incorporation with a capital stock of $75,000. The principal place of business will be at Chicago, Ill. The incorporators are Elmer C. Brain, Morgan; W. D. Ball, Fred Lehman, J. C. Yynas and W. A. Buchanan, of Chicago, Ill.

NEW ALBANY, IND.—The Travelers' Protective Association, Post Q, has completed arrangements for the construction of a "White Way," in the business district of this city, and the following committee has been appointed to have in charge carrying out the plans: Julius Sapinsky, Charles M. Zink and J. A. Kraft.

ALAMEDA, CAL.—The bond resolution, calling for a $200,000-bond issue for city improvements, has been adopted by the City Council. The issue provides for a new building for the electric light plant and the moving of the plant from the south end of Park Street to the corporation yard at the north end of Grand Street.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed by the Butte & Tehama Power Company with a capital stock of $1,000,000. Luke McDonald, L. A. McIntosh, R. L. Kittrick, J. E. Frick and Leon Bly are named as the directors. The company will manufacture gas and electric power.

GREENVILLE, KY.—J. A. Rose, electrician for the Greenville Light & Water Company, is planning the construction of an electric power plant at a point between Greenville and Central City. It will be used to operate an interurban railway which Mr. Rose has in mind, as well as to provide current for a large number of coal mines in that district.

SHILOH, O.—The Shiloh Improvement Association is strongly urging the erection of a rural electric power station on an old mill site near Dayton. It is planned to generate current for at least 2,000 incandescent lamps, in which event negotiations will be entered into to supply the residents of Shiloh with lighting current.

JOLIET, ILL.—Sealed bids will be received by the City Clerk until April 1 for lighting the streets of the City of Joliet; lights to burn all night and every night from dusk until dawn. Bids shall be submitted on a basis of 420 lamps or less, and shall be accompanied by a certified check upon some national bank in the sum of $100.

WYOMISSING, PA.—Sealed proposals will be received by the Borough Council until April 11 for lighting certain of the streets by incandescent electric lighting for three-year, five-year and ten-year terms, beginning June 1. The number of lamps, specifications, etc., can be secured by applying in writing to the Secretary of the Council.

BOSWELL, IND.—The Citizens' Light & Water Company has filed articles of incorporation with a capital stock of $10,000. The object of the corporation is to build, equip and operate a plant to furnish electricity for light and power, and a joint plant to furnish water to the citizens of Boswell. J. F. Brubaker, A. M. Bristor and W. B. Waddell are the directors of the company. S.

PROVIDENCE, R. I.—The Rhode Island Power Transmission Company has been incorporated with a capital stock of $500,000. The incorporators named are Jonathan Chace, John A. Ames, Henry I. Harriman, Philip Young, Herbert F. H. Hinckley and Frank L. Hinckley. The purpose of the company is to furnish electricity for lighting, heating and power in this state.

MEXICO CITY, MEX.—Ernesto F. Ayton and associates will install a large hydroelectric plant near Guanacevi, Durango, and construct a system of power transmission lines to towns and mining camps in that section. They will utilize the water of the Guanacevi River for the purpose of generating initial energy. Mr. Ayton has applied to the federal government for a concession for the proposed enterprise. D.

SEGUIN, TEX.—The Guadalupe Water Power Company has filed articles of incorporation with the Secretary of State, the capital stock being $600,000. The purpose of the new corporation is to make, sell and transport electric power for public and private illumination and for manufacturing purposes. The incorporators are W. B. Dunlap, Beaumont, Tex.; E. W. Brown and J. M. Abbott.

DEMING, N. M.—The Federal Light & Traction Company, of New York, has closed a deal for the purchase of the properties of the Deming Ice & Electric Company, at this place. It is announced that the new owner will install additional electrical equipment and make extensions to a number of points in the Mimbres Valley. The power furnished by this company is used chiefly for the operation of irrigation pumping plants in this district. D.

THE DALLES, ORE.—Plans for the new substation of the Pacific Power & Light Company are complete and work will start in the near future. The work contemplates the entire removal of the apparatus now installed in the brick building at Fourth and Jefferson Streets. Three new transformers will be put in, each with capacity of 500 kilowatts. Transmission lines will enter the substation both from Hood River and from White River. The work is estimated to cost $15,000.

SAN FRANCISCO, CAL.—The old Mount Shasta Power Company has reorganized and filed articles of incorporation with a capital stock of $10,000,000. The directors are Joseph Haber, Jr., San Francisco; Charles L. Firebaugh, Oakland; Leopole Oppenheimer, San Francisco, and Edgar Sinsheimer. The company intends to begin work at once on active development. It will take water from the Pit River and generate electrical power to supply Sacramento and San Francisco.

BELLINGHAM, WASH. — The Board of County Commissioners has granted a 50-year franchise to the Whatcom County Railway & Light Company to build a high-power transmission line over the Guide Meridian road to connect with the line of the Western Canada Power Company at a point near Sumas. Preliminary work will be started immediately and it is expected that the line will be ready by the middle of summer. More machinery will be installed in the city distributing plant and a large addition will also be built.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

TERRY, MONT.—The farmers south of here will build a telephone line this spring. C.

NEW ORLEANS, LA.—The Cumberland Telephone Company will rebuild its lines in this city.

CAKOTA, MINN.—The Knapp Telephone Company will start building new lines as soon as spring opens. C.

MINDEN MINES, MO.—The Minden Telephone Company has been organized by W. E. Barkley and others.

MURDOCK, MINN.—The Louriston Telephone Company has voted to make improvements to the line and string another wire. C.

IONA, MINN.—Farmers in this vicinity have organized a telephone company. The work of constructing lines will be started soon. C.

VALENTINE, TEX.—S. C. Bunton has purchased the local telephone exchange and will make improvements to the property. D.

SAN FRANCISCO, CAL.—Plans are being prepared for alterations for the Pacific States Telephone Company on Calp Street to cost $25,000.

RAEFORD, N. C.—H. C. Heins has purchased the Raeford telephone exchange and will make improvements and extensions to the system.

MISSOULA, MONT.—Cable conduits for the telephone wires of the Mountain States Telephone & Telegraph Company, will be constructed here this spring. C.

PRINCETON, ME.—The Eastern Telephone Company has completed a survey for a line from Princeton to Danforth and construction work will start early in May.

PRINCETON, MINN.—The Princeton Bogus-Brook Telephone Company was organized. A metallic system will be put in and connections made with the Tri-State lines. C.

SAN FRANCISCO, CAL.—In order to raise money to extend its telephone system the Home Long Distance Telephone Company has voted to issue bonds for $7,080,000.

BRADY, TEX.—George Vierling, Jr., has purchased the holdings of the Brady Telephone Company, and announces that he will make important extensions and improvements. D.

KINGMAN, KANS.—The Bell Telephone Company is preparing to build another toll line from Kingman, through Turon, to Larned. Two more lines will also be strung from Kingman to Wichita.

MEADOW BLUFF, W. VA.—Meadow Bluff Mutual Telephone Company has been incorporated with a capital stock of $5,000 by William H. McClung, D. G. Martin, H. E. Sharp, W. B. Jones and others.

SOUTH BEND, IND.—The Central Union Telephone Company announces that it will expend $80,000 in improvements in the South Bend exchange, and a large sum on cable lines. The work is to be begun next month. S

SALMON, TEX.—The Farmers' Union Telephone Company has been organized here for the purpose of constructing long-distance lines to localities in this section. It will also install local exchanges at Salmon and other places. D.

AUSTIN, TEX.—It is the purpose of the Southwestern Telegraph & Telephone Company to reconstruct the long-distance lines and make many improvements to the different local exchanges. It will also make important extensions of the added lines. D.

SAN ANGELO, TEX.—The Rio Grande Telephone Company, which operates exchanges at Alpine and Fort Stockton, has purchased the Bennet Telephone System and will extend long-distance lines to connect with the San Angelo company's lines.

ASTORIA, ORE.—The Mutual Telephone Company has filed articles of incorporation with a capital stock of $2,500. The incorporators are W. D. Torrey, A. J. Gregg and I. N. Fleischner. The company will operate a telephone line from Seaside to Arch Cape.

MERCED, CAL.—Merquin Telephone & Electric Light Company has filed articles of incorporation with a capital stock of $25,000 for the purpose of furnishing Stevinson Colony with telephone and electric light service. A. L. Bruce is president of the company; David Larson,

FT. STOCKTON, TEX.—The Rio Grande Telephone Company has purchased the Bennett Telephone Company's system of Ozona, and is preparing to extend its long-distance system to connect with the newly acquired system and also to San Angelo. D.

DALLAS, TEX.—J. E. Farnsworth, vice-president of the Southwestern Telegraph & Telephone Company, has made the announcement that his company has purchased numerous lines in the lumber district of Eastern Texas and that it will build an entirely new line from Jasper to Beaumont.
secretary, and W. H. Joy, treasurer.

MONTEREY, MEX.—The Mexican Telephone Company has begun the work of rehabilitating its telephone exchange and system here, the estimated cost of which is $500,000. A new two story brick exchange building will be erected and the wires in the business district placed underground; a new switchboard will be installed, and many other improvements made to the property. D.

ELECTRIC RAILWAYS.

(Special Correspondence.)

OLIVET, S. D.—An interurban line to connect with the Milwaukee Railway at Tuscan, is planned by a group of local capitalists.

SAN BERNARDINO, CAL.—The Redlands-San Bernardino narrow-gauge steam line is to be standardized and operated as an electric road.

MERIDIAN, MISS.—The street car company at this place has secured permission to run the line to the cotton mill and work will soon be started.

TAMPA, FLA.—It is reported that a gigantic scheme by Northern capitalists is on foot to build an electric railway between Tampa and Palm Beach.

CALGARY, ALTA.—The Alberta Inter Urban Railway will spend over $1,000,000 here this year. A 50-mile line from Calgary to Carbon will be constructed. C.

PENSACOLA, FLA.—Former Chief Engineer Proctor of the Big Four is among the promoters of a gas-electric car system which it is proposed to run between Mobile, Ala., and this city.

TOLEDO, O.—The Columbus, Kenton & Toledo Traction Company has been incorporated with a capital stock of $50,000 for the purpose of establishing a through short-line between Columbus and Toledo. Burr Fennel, Kenton, is back of the company. H.

ASHEVILLE, N. C.—A survey is being made for the proposed electric line to run from Asheville, *via* Leicester, Canton, Clyde and on to Waynesville. It is understood that the Southern Power Company is going to take hold of the matter and that the line will be built in the near future.

CHATTANOOGA, TENN.—A franchise ordinance enabling the Chattanooga Traction Company to operate in this city has been signed by the mayor. The company intends to build interurban lines to Nashville, Knoxville and Atlanta, and has let the first contract for grading. C. E. James and others are interested in the company.

SAN FRANCISCO, CAL.—The San Ramon Valley Railroad Company has filed articles of incorporation with $250,000 capital stock for the purpose of building seven miles of road from Danville to Walnut Creek. The directors of the company are Jessie H. Steinhart, A. W. Jones, G. Miller, S. S. Palmer and George W. Merrill.

ONTARIO, CAL.—The announcement that the United States government is to survey and in all probability dredge Newport Harbor has renewed interest in an old project to build an electric railway from Ontario by way of Santa Ana to the proposed harbor, a distance of 32 miles. Part of the right of way has recently been secured by a company backed by Charles Frankish and known as the Ontario Interurban Railway Company.

INDIANAPOLIS, IND.—Articles of incorporation have been filed by the Indianapolis, New Castle & Northeastern Traction Company with a capital of $10,000. The new company will construct and operate a traction line from Indianapolis, by way of Shirley, Kenard, New Castle, Hagerstown, Richmond, Lynn, Winchester to Muncie. The incorporators are Joseph T. Elliott, G. B. Elliott, Edgar Elliott and J. H. Hornbrook, all of Indianapolis. S.

FORT WORTH, TEX.—The Fort Worth Mineral Wells and Northwestern Railroad Company, which was recently organized here with a capital stock of $100,000, will construct an interurban electric line between Fort Worth and Mineral Wells, a distance of about 60 miles. It is planned to ultimately extend the line west to Roswell, N. M. The directors of the company are J. S. Hanford and Paul Hurley, of Fort Worth, and James A. Watkins, of Little Rock, Ark. D.

CANBY, ORE.—The Canby-Molalla Railway Company has filed articles of incorporation with a capital stock of $100,000 for the purpose of building an electric line from Canby, through the Southeastern section of Clackanas County. An auxiliary company has plans for constructing an immense dam across the Molalla River above Canby for the storing of water for irrigation and power purposes. It is also stated that the ultimate plan of these interests is to construct an electric line from Canby into the Tualatin Valley district and thence to Portland.

SACRAMENTO, CAL.—The Tidewater & Southern Railroad Company and the Tidewater & Southern Railway Company have been consolidated into the Tidewater Southern Railway Company, with a capitalization of $5,000,000 and will construct a system of electric lines through the San Joaquin Valley. The directors are Karl C. Brueck, Byron A. Bearce, J. L. Craig, George Schuler, W. G. Wallace, T. J. Wisecarver and Frank A. West, of Stockton; Ward B. Minthurn, Frank Helm and W. M. Giffen, of Fresno, M. D. Wood, Merced, and Claus Johnson, Turlock.

PROPOSALS.

ELECTRIC WIRING AND FIXTURES.—Sealed proposals, in triplicate, will be received by the Quartermaster, Fort Robinson, Neb., until April 4, for furnishing electric wiring and fixtures required for the improvement of the hospital at that post. Full information, plans and specifications furnished on application to the Quartermaster. A deposit of $5.00 required for the plans.

ELECTRIC LIGHTING.—Sealed proposals, in triplicate, will be received at Fort Dupont, Delaware City, Del., until April 8, for the electric lighting of a quartermaster's stable at Fort Dupont. Information furnished upon application. Envelopes containing bids should be indorced "Proposals for Quartermaster's Stable," and addressed to the Quartermaster, Fort Dupont, Delaware City, Del.

ELECTRIC CABLE.—Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until April 3, for furnishing electric cable during the period of 15 months beginning with April 3, as per Canal Circular 695.

ELECTRICAL SUPPLIES.—Proposals will be received until April 13 by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., for the following material:

Article	Quantity	Delivered at navy yard.	Schedule
Motors, induction and direct current	4	Washington, D. C.	4426
Transformers and storage battery	3	"	4426

and until April 23 for the following material:

Article	Quantity	Delivered at navy yard.	Schedule
Annunciators, water-tight	29	All	4432
Appliances, wiring	Miscellaneous	"	4432
Batteries, Le Clanche, Gonda	"	"	4432
Bells and buzzers, water-tight	"	"	4432
Bells and buzzers, nonwater-tight	"	"	4432
Boxes, connection	"	"	4432
Bushings, electrose insulating	90	"	4432
Buttons, push	Miscellaneous	Eastern	4432
Buttons, push, nonwater-tight	980	"	4432
Buttons, push, water-tight	1,950	"	4432
Buzzers, portable, salvo	Miscellaneous	All	4432
Carbons, searchlight	"	"	4432
Cells, reserve type	"	"	4432
Controllers, combination truck and speed light		Eastern	4432
Fiber, sheet, red	8	All	4432
Fittings, interior	Miscellaneous	"	4432
Fuses, inclosed cartridge type	"	"	4432
Fuses, glass, tube	"	"	4432
Fuses, link	"	"	4432
Generators, testing	"	"	4432
Heaters, electric, desk-type	"	"	4432
Irons, electric, soldering	"	"	4432
Irons, flat, electric	"	"	4432
Insulators, Electrose	"	"	4432
Keyboards, night, signal	"	Washington, D. C.	4433
Machine, electric blue-printing	1	All	4432
Mica and micanite	Miscellaneous	Brooklyn, N. Y.	4432
Portables, watertight	200	All	4432
Portables, nonwater-tight	Miscellaneous	"	4432
Pots, electric, soldering	"	"	4432
Plugs, water-tight attachment	"	Eastern	4432
Reflectors, prismatic	800	"	4432
Rings, soft, rubber	Miscellaneous	All	4432
Rod, hard, rubber	"	"	4432
Sets, portable, testing	8	"	4432
Sets, portable, ventilating	Miscellaneous	Puget Sd., Wash.	4432
Shades and globes	1	"	4420
Shears, alligator, motor-driven	"	All	4432
Sockets, lamp	"	"	4432
Sockets, key, bronze	"	"	4432
Sockets, hard, rubber	"	"	4432
Socket, keyless, bronze	"	"	4432
Strips, searchlight	"	"	4432
Switches, action, cutout	"	Eastern	4432
Terminals, wire	"	All	4432
Terminals, wire, wrought copper	1,300	Mare Island, Cal.	4432
Wire, fuse	Miscellaneous	Eastern	4432
Wire, magnet	"	All	4432

Schedules may be obtained from the Navy Pay Office nearest each Navy Yard. In making application the schedule number should be given.

FINANCIAL NOTES.

The mercurial quality of industrial stocks was in evidence all last week, particularly toward the end of the business session of the leading stock markets, when substantial increases in security values were recorded. The lessening fear of federal prosecution of industrial corporations and the decreased uneasiness with respect to the probability of alteration of existing tariff schedules, has discounted to a considerable extent the apprehensions earlier manifested because of the pre-presidential-year conditions. Advances in the prices of copper and certain steel products have been positive factors in altering general opinion favorably toward industrial conditions. The impression that last year's decline in prices had fully discounted all unfavorable factors has also had something to do with the improved conditions evident at this time.

The purchase of the Winnipeg street-railway lines and the light, heat and power plants by the J. P. Morgan interests of New York, was completed at Winnipeg on March 18. The purchasers announce that $15,000,000 will be expended in extensions.

The report on telephone companies operating in Canada submitted to Parliament, shows that the total capital liabilities of the 537 companies is $40,943,982. Gross earnings for the year amount to $19,968,220. Net earnings were $3,089,174.

The Monongahela Traction Company has been organized under the laws of West Virginia to take over the Fairmont & Clarksburg Traction Company, the Fairmont & Northern Traction Company, and the Clarksburg & Western Electric Railway, properties controlled by interests identified with the Consolidation Coal Company.

An act to incorporate the Blackstone Valley Gas & Electric Company has been introduced in the general assembly at Providence, R. I. The companies which this company desires to merge are the Woonsocket Gas Company, the Woonsocket Electric Machine & Power Company, the Pawtucket Gas Company, and the Pawtucket Electric Company.

The financial statement of the Electric Bond & Share Company, as of December 31, 1911, shows current assets of $1,996,772.88; syndicate holdings, underwritings and advances, $1,049,401.62; investments, $3,748,086.30; total assets, $6,794,260.80. The surplus and undivided profits amount to $2,314,223.82.

Application has been made to the New York Exchange to list Detroit Edison, $1,500,000 additional capital stock.

A dispatch from Nashville gives further details regarding the proposed acquisition of the properties of the Nashville Railway & Light Company by H. M. Byllesby & Company, of Chicago, and associates in New York. It is stated that they have been given an option on the properties mentioned in consideration of $120,000 cash. The option is good until May 30, 1912, when holders of the property are to surrender 30,000 of the 40,000 shares of the Nashville Company's stock. Stockholders are to receive $114 for their stock, the $120,000 option being three per cent of the $4,000,000 common stock. The company is allowed to declare a dividend of eleven per cent, payable in bonds of the company at par or in cash, optional with Byllesby & Company, and then the stock is to be taken at par, making in all 114.

Dividends.

American Power & Light Company; a quarterly preferred dividend of 1.5 per cent, payable April 1 to stock of record March 23.

The Bell Telephone Company, of Canada; regular quarterly dividend of two per cent, payable April 15 to stock of record March 25.

Butte Electric & Power Company; a quarterly dividend of 1.75 per cent, payable April 1 to stock of record March 20.

Carolina Power & Light Company; a quarterly preferred dividend of 1.75 per cent, payable April 1 to stock of record March 23.

Cincinnati & Hamilton Traction Company; a quarterly preferred dividend of 1.25 per cent, payable April 1.

Detroit Edison Company; a quarterly dividend of 1.75 per cent, payable April 15 to stock of record March 30.

East Michigan Edison Company; a quarterly dividend of one per cent, payable April 1.

Electric Storage Battery Company; a quarterly common dividend of one per cent, and a quarterly preferred dividend of one per cent, both payable April 1 to stock of record March 25.

Halifax Electric Tramway Company, Limited; a quarterly dividend of two per cent, payable April 1 to stock of record March 20.

Kansas Gas & Electric Company; a quarterly dividend of 1.75 per cent, payable April 1 to stock of record March 23.

Louisville Home Telephone Company; a quarterly dividend of 1.5 per cent, payable April 1.

Massachusetts Lighting Company; a quarterly dividend of 1.75 per cent, payable April 15.

National Gas, Electric Light & Power Company; a quarterly preferred dividend of 1.5 per cent, payable April 1 to stock of record March 27.

Philadelphia Company; a quarterly common dividend of 1.5 per cent, payable May 1 to stock of record April 1.

Republic Railway & Light Company; a regular quarterly dividend of 1.5 per cent.

Ridge Avenue Passenger Railway Company; regular quarterly dividend of $3 per share, payable April 1 to stock of record March 16.

Shawinigan Water & Power Company; a common dividend of one per cent, payable April 20 to stock of record April 7.

Union Railway Gas & Electric Company; a quarterly preferred dividend of 1.5 per cent, payable April 1 to stock of record March 22.

Virginia Railway & Power Company; a common dividend of one per cent, payable April 20 to stock of record April 10.

Western Electric Company; the regular quarterly dividend of $2 per share, payable March 30 to stock of record March 23.

Reports of Earnings.

MISSOURI & KANSAS TELEPHONE COMPANY.

	1911	1910
Gross	$3,523,033	$3,182,397
Expenses and taxes	2,823,992	2,501,155
Net	699,041	681,242
Interest and depreciat'n	699,041	681,242
Previous deficit	575,317	575,317
Total deficit	575,317	575,317

UNION ELECTRIC LIGHT & POWER.

	1911	1910
Gross revenue	$3,602,666	$3,371,520
Operating expenses, taxes and reserve	1,955,550	1,767,211
Net revenue	1,647,116	1,604,309
Interest and charges	850,878	823,341
Surplus	*796,238	780,968

*Equal to 8.05 per cent on $9,885,000 capital stock, as compared with 7.90 per cent earned on same stock previous year.

PUBLIC SERVICE CORPORATION OF NEW JERSEY.

The report of the Public Service Corporation of New Jersey for the year ended December 31, 1911, shows a gross income of $32,016,020, a marked increase over the previous year. The income account of the constituent companies follows:

	1911	1910.
Gross revenue	$32,016,020	$29,205,194
Exp., tax., amortiz'n.	16,614,345	14,611,297
Net revenue	15,401,675	14,593,896
Charges, etc.	13,606,893	12,393,599
Surplus	1,794,782	2,200,297

NORTH AMERICAN COMPANY.

The annual report of the North American Company for the year ending December 31, 1911 shows a surplus of $367,201 after paying out $1,489,665 in dividends. The report compares with 1910 figures as follows:

	1911	1910
Total receipts	$2,105,993	$2,105,003
Rents, taxes, etc.	249,127	251,618
Undivided profits	$1,856,866	$1,853,385
Dividends	1,489,665	1,489,665
Surplus	$ 367,201	$ 363,720

CANADIAN GENERAL ELECTRIC COMPANY.

It is stated in the annual report of the Canadian General Electric Company, Ltd., that the year ended December 31, 1911, was the most prosperous in the history of the company. A total surplus of $2,345,312 is shown. A summary of the income account follows:

	1911	Increase
Profits	$1,405,890	$494,682
Depreciation	353,722	165,634
Interest	162,423	85,603
Total deduction	516,145	251,237
Balance	889,745	243,445
Dividends	525,109	30,485
Surplus	364,636	212,960
Previous surplus	1,980,676	151,676
Total P. & L. surplus	2,345,312	364,636

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Mar. 25.	Mar. 18.
Allis-Chalmers common (New York)	⅛	¾
Allis-Chalmers preferred (New York)	3	5
American Tel. & Tel. (New York)	148⅜	147¼
General Electric (New York)	166¾	164½
Kings County Electric (New York)	129	129
Postal Telegraph and Cables common (New York)	79½	80½
Postal Telegraph and Cables preferred (New York)	69	69
Western Union (New York)	84¼	84¼
Westinghouse common (New York)	78½	74
Westinghouse preferred (New York)	119¾	118
Edison Electric Illuminating (Boston)	298	298
Massachusetts Electric common (Boston)	21⅞	21
Massachusetts Electric preferred (Boston)	96¼	96
New England Telephone (Boston) (ex-dividend)	160	160
Electric Company of America (Philadelphia)	12	11⅞
Electric Storage Battery common (Philadelphia)	56	56
Electric Storage Battery preferred (Philadelphia)	56	56
Philadelphia Electric (Philadelphia)	18	18⅜
Chicago Telephone (Chicago)	*144	144
Commonwealth Edison (Chicago)	145	147½
National Carbon common (Chicago)	105	105
National Carbon preferred (Chicago)	116½	116¼

*Last price quoted.

A special meeting of the stockholders has been called to vote upon increasing the authorized capital stock of the company to $12,000,000.

KINGS COUNTY ELECTRIC LIGHT & POWER.

The report of the Kings County Electric Light & Power Company for the month of February and two months ended February 29, 1912, compares as follows:

	1912	1911
February gross	$447,070	$386,373
Expenses, taxes and depreciation	268,075	232,509
February net	178,995	153,864
Other income	4,626	5,625
Total income	183,621	159,490
Charges	72,236	64,736
February surplus	111,385	94,754
Two months gross	946,047	828,797
Expenses, taxes and depreciation	548,767	485,615
Two months net	397,280	343,181
Other income	9,438	10,909
Total income	406,718	354,090
Charges	144,471	129,471
Two months surplus	262,247	224,619

ELECTRIC STORAGE BATTERY COMPANY.

The annual report of the Electric Storage Battery Company, for the year ended December 31, 1911, is issued. The income account compares with the previous year as follows:

	1911	1910
Gross sales less cost of manufacturing, etc.	$1,479,453	$1,314,223
Operating expenses	452,706	442,650
Net	1,026,747	871,572
Other income	236,861	248,439
Total income	*1,263,608	1,120,012
Dividends	649,964	649,964
Surplus	613,644	470,048
Previous surplus	2,771,942	2,358,816
Adjustments, debit	67,505	56,922
Total surplus	3,318,080	2,771,942

*Equal to 7.02 per cent on $18,000,000 capital stock ($185,400 preferred), as compared with 6.22 per cent on same stock previous year.

At the annual meeting of the Electrc Storage Battery Company, officers were re-elected.

REPUBLIC RAILWAY & LIGHT COMPANY.

The combined gross earnings of the constituent companes of the Republic Railway & Light Company for the year ending January, 1912, were $2,389,203, an increase of $130,329 over the previous year. The income account follows:

12 MONTHS ENDING JANUARY.	1912	Increase
Gross earnings	$2,389,203	$130,320
Oper. expenses and taxes	1,416,397	85,065
Net earnings	$ 972,806	$ 45,264
Interest on funded debt	531,374	28,244
Surplus	$ 441,431	$ 22,019
FOR MONTH OF JANUARY.		
Gross earnings	$ 201,082	$ 14,102
Oper. expenses and taxes	122,599	7,268
Net earnings	$ 78,482	$ 6,833
Interest on funded debt	44,424	2,084
Surplus	$ 34,058	$ 4,749

SUSQUEHANNA RAILWAY, LIGHT & POWER.

The income account of the Susquehanna Railway, Light & Power Company for the year ended December 31, 1911, compares as follows:

	1911	1910
Earnings, less expenses, incl. subsidiary companies	$615,602	$514,370
Preferred dividends	214,051	204,610
Common dividends	83,606	.....
Net earnings added to surplus subsidiary companies	261,751	247,164
Balance from operation	54,194	62,596
Previous surplus	295,086	174,546
Profits from merger United Service Co. assets	44,050	.....
Profit sale of securities	.....	67,942
Profit and loss surplus	393,334	295,086

WESTERN ELECTRIC COMPANY.

The Western Electric Company has issued its report for the year ended December 31, 1911. The income account compares with the thirteen months ended December 31, 1910, as follows:

	1911	†1910
Gross sales	$66,211,975	$68,375,150
Other income	337,293	486,305
Total income	66,549,268	68,861,455
Manufacturing costs, expenses, etc.	62,414,067	63,442,286
Net earnings	4,135,201	5,419,169
Interest charges	854,909	884,893
Balance for dividends	*3,280,292	4,534,276
Dividends	1,500,000	1,700,000
Carried to reserve	800,000	1,150,000
Surplus	980,292	1,684,276

*Equal to 21.87 per cent earned on $15,000,000 capital stock as compared with 30.2 per cent earned on same stock for thirteen months ended December 31, 1910.

†Thirteen months ended December 31.

NORTHERN OHIO TRACTION & LIGHT.

The report of the Northern Ohio Traction & Light Company for the month of February and two months ended February 29, 1912, compares as follows:

	1912	1911
February gross	$198,209	$172,413
February net	78,654	67,545
Surplus after charges	34,833	23,187
Two months gross	407,598	358,684
Two months net	165,507	146,912
Surplus after charges	77,861	58,126

PERSONAL MENTION.

GLENN C. WEBSTER, manager of the Engineering Department of the National Electric Lamp Association, Cleveland, O., started on March 12 on a trip through the South, where he will visit the principal cities of Tennessee,

Glenn C. Webster.

North and South Carolina, Georgia, Florida, Alabama, Mississippi and Louisiana in the interests of the incandescent-lamp industry. A study of the incandescent-lamp consumption in the United States, from data recently compiled by Mr. Webster, indicates that the South Atlantic and Gulf States are not keeping pace with other sections of the country. Statistics show that incandescent-lamp sales in Tennessee, Virginia, North and South Carolina, Georgia, Florida, Alabama, Mississippi and Louisiana amount to about 28 lamps per hundred inhabitants, or an average of little better than one lamp for every four persons. This is in marked contrast with the 150 lamps used per hundred inhabitants on the Pacific Coast, or with the one lamp per capita used in those states bordering on the Great Lakes. Mr. Webster is deeply interested in the co-operative movement on foot among the men connected with all branches of the electrical industry and is recognized as a leading spirit in the progressive Electrical League of Cleveland. During a recent visit to the Pacific Coast he participated in the launching of the Electrical Development League of San Francisco and in a similar organization among the members of the electrical fraternity of Los Angeles, Cal.

BANCROFT GHERARDI delivered an address before the Telephone Society of New York City on March 19 on the subject of "Telephone Transmission."

WILLIAM MARCONI, the famous inventor of wireless, will address the New York Electrical Society on wireless developments at the April meeting of the Society.

CARL L. MEES, president of Rose Polytechnic Institute, delivered an address on "Electrical Phenomena," before the Engineers' and Architects' Club at Louisville, Ky., recently.

A. E. LUBECK has recently been added to the sales force of the Benjamin Electric Manufacturing Company, of Chicago, Ill., traveling through the Middle Western States.

H. B. KINNEY, manager of the Western States Gas & Electric Company, Santa Rosa, Cal., has been appointed superintendent of the Northern Division of that company.

WILLIAM NELSON PELOUZE, president of the Pelouze Manufacturing Company, Chicago, accompanied by Mrs. Pelouze, sailed from Seattle, Wash., March 16, for an extended business and pleasure trip to China, Japan and Australia.

FRED W. ADAMS, for several years general manager of the Toledo, Fostoria & Findlay Railway Company, Fostoria, O., has severed his connection with that company to become general manager of the National Clay Products Company, Colorado Springs, Colo.

T. C. CHERRY, of Utica, N. Y., will succeed Edward F. Peck, as general manager of the Schenectady Railway Company. The resignation of Mr. Peck which was announced some time ago, went into effect on March 18. Mr. Peck will hereafter be connected with the firm of Allen & Peck, Incorporated.

R. F. SCHUCHARDT delivered an address to the Commonwealth Edison Section of the National Electric Light Association on March 26, entitled, "A Trip to the Panama Canal, the Canal Zone and Central America." The talk was illustrated with more than 125 lantern slides from photographs taken by Mr. Schuchardt.

S. B. CUSHING, statistician of the Public Service Company of Northern Illinois, presented a paper entitled "The Organization of a Public Service Corporation" before the Armour Institute of Technology Branch of the American Institute of Electrical Engineers on the evening of March 27. The meeting was held in Chapin Hall, Chicago, Ill.

DORRIS WHIPPLE, chief chemist of the Safety Insulated Wire & Cable Company, made an address on the chemistry of rubber and the ethics of cable-making before the Minnesota Electric Club last week. Dr. Whipple's address was thoroughgoing, of a highly instructive and interesting nature, and was greatly enjoyed by a large gathering.

FRANK L. PERRY, who is now associated with the C. W. Lee Company,

was the speaker at the weekly luncheon of the Advertising Club of Baltimore at the Hotel Rennert last wek. Mr. Perry has visited 35 cities in the United States since October, with the object of investigating local conditions, local sentiment, and local management of public-utility companies. His subject was "Publicity for Public-Utility Companies and Popular Unrest." Mr. Perry said: "Be a good company and never stop telling the people how good you are." "The greatest need," he concluded, "for these companies is real publicity—telling the people what they are doing and how they are doing it."

OBITUARY.

CHARLES W. HENDERSON, one of the best known telegraph men in New England, died on March 20 at his home in Dorchester, Mass. Mr. Henderson was born at Somersworth, N. H., July 11, 1843, and started in telegraph work in 1859. In 1865 he entered the service of the Western Union Telegraph Company in Boston, and in 1881 became manager of the Boston District. In 1901 he was made claim adjuster, which position he retained until last summer, when he was retired on a pension. Mr. Henderson is survived by his wife and daughter.

FOREIGN TRADE OPPORTUNITIES.

(*Parties interested in the following item should address the Bureau of Manufactures, Washington, D. C., and refer to the file number noted.*)

No. 8359. TELEPHONE APPARATUS AND EQUIPMENT.—Application has been made by an individual to a Latin-American Government for a concession for the establishment of telephone service in various cities. The conditions of the concession applied for include exclusive privilege for 20 years of placing the necessary posts and wires in the public roads, the importation free of duty of wire, switches and other telephone apparatus.

NEW INCORPORATIONS.

ST. LOUIS, OKLA.—The Independent Electric Supply Company has been incorporated with a capital stock of $10,000.

LOS ANGELES, CAL.—The Lorbeer Electric Supply Company has been incorporated with $25,000 capital stock.

FRESNO, CAL.—The Lewis Electric Company has filed articles of incorporation with $10,000 capital stock. The incorporators are H. W. and I. E. Lewis and S. E. Check.

ALBANY, N. Y.—W. S. Fallon Company has been incorporated with a capital stock of $15,000 to install electrical signs. The incorporators are Wilmer S. Fallon, Herman Tusch and D. Eugene Strouss, all of Rochester.

YOUNGSTOWN, O.—O. K. Incandescent Light Company has been incorporated with a capital stock of $25,000 to manufacture electric heating appliances. The incorporators are C. A. Manchester, Leroy Manchester, Dudley R. Kennedy, S. S. Conroy and L. M. Montgomery.

OAKLAND, CAL. — The Pacific Coast Carbon Company has filed articles of incorporation with $300,000 capital stock for the purpose of manufacturing all kinds of carbon products. R. C. Shaw, is president; A. G. Taft, vice-president; R. G. Erskine, secretary; and W. B. Straub and W. P. Swart, directors.

RIVERSIDE, CAL.—Articles of incorporation have been filed by the Southern Utilities Company, which proposes to furnish power for the San Diego, Riverside & Los Angeles Railroad Company. The capital stock of the company is $10,000,000, and the directors are Charles E. Waite, M. M. Milioe, Lamont Simms, E. Pelonbet.

NEW PUBLICATIONS.

INDUCTANCE.—Vol. 8, No. 1, of the *Bulletin of the Bureau of Standards* is devoted to formulas and tables for the calculation of mutual and self inductance. It is a revision by E. B. Rosa and F. W. Grover of a previous publication on this subject.

IMPROVEMENTS IN BOILERS AND FURNACES.—We are in receipt of a reprint of an article on this subject by R. Klein, which was published in the *Schweizerische Bauzeitung*. The article deals with some of the latest ideas in furnace and boiler construction and operation.

BUSINESS FEATURES OF ENGINEERING PRACTICE.—Alexander C. Humphreys, president of Stevens Institute of Technology, is the author of "Lecture Notes on Some of the Business Features of Engineering Practice." These lecture notes have been revised and enlarged upon, and the volume bearing the above title has been published by the Department of Economics of Engineering of Stevens Institute.

LUX ET VERITAS.—Under the title of *Lux et Veritas* the Opalux Company, 258 Broadway, New York, has published one of the most interesting studies of the subject of applied illumination. In addition to a great deal of excellent material respecting characteristics of the various forms of glassware either manufactured or handled by this company, there is some philosophy which is instructive and interesting. The volume is well laid out, is handsomely illustrated, well printed, and is a credit indeed to the company and the editor of the publication, F. Laurent Godinez, consulting specialist on illumination.

THE TRIUMPH CHRONICLE.—The Triumph Electric Company and the Triumph Ice Machine Company, Cincinnati, O., have begun publication of the *Triumph Chronicle*, devoted to the interests of Triumph electrical and refrigerating apparatus. The little magazine is full of interesting information respecting the products of this company, and personal notes relating to the home office and the work in the field. There are also several pages devoted to lighter form of reading, the whole being attractively presented and embodying that finish and excellence which one might expect from the Triumph organization, and especially the editor of the magazine, J. F. Nisbet.

WATER RESOURCES OF THE NORTHWEST.—The Geological Survey has recently issued a valuable publication concerning the surface water resources of the northwestern portion of the United States, the greater part of which is occupied by the basin of Columbia River. This river has a drainage area of 259,000 square miles. Within the drainage basin are at least one-third of the available water powers in the United States, but development of this resource has scarcely begun. Water-Supply Paper 272, of the Survey, which has just been issued, contains a large amount of useful data resulting from the investigations of the streams of this area, including the records of flow of the numerous large tributaries as well as the main rivers.

UNIVERSAL ELECTRICAL DIRECTORY.—The 1912 edition of the Universal Electrical Directory, published by H. Alabaster, Gatehouse & Company, London, England, has appeared. This edition has been carefully revised and no pains have been spared by the publisher to make it accurate and reliable. A total of 34,485 names is given, distributed as follows: British, 13,830; Colonial and General, 6,100; Continental Europe, 8,000; United States, 6,555. Each section is given in alphabetical and classified forms. In the British section the London and provincial names have been separated. Telegraphic addresses, telephone numbers and codes are given in the alphabetical sections. The lists of central stations in Great Britain, the colonies and certain other countries include the nature of the supply, the system of distribution, capacity of the plant voltage, chief engineer's name; and in the case of alternating current, phase and frequency also. The price of the directory is 14 shillings, 6 pence.

DATES AHEAD.

American Institute of Electrical Engineers. Pacific Coast meeting, Portland, Ore., April 16-20.

American Electrochemical Society. Twenty-first general meeting, Boston, Mass., April 18-20.

Iowa Electrical Association. Annual meeting, Des Moines, April 24-25.

Iowa Street and Interurban Railway Association. Annual meeting, Des Moines, April 25-26.

Association of Iron and Steel Electrical Engineers—American Institute of Electrical Engineers. Joint meeting, Pittsburgh, Pa., April 25-27.

Southwestern Electrical and Gas Association, San Antonio, Tex., April 25-27.

American Institute of Electrical Engineers. Schenectady, N. Y., May 17.

Arkansas Association of Public Utility Operators. Annual convention, Little Rock, Ark., May 20-22.

Mississippi Electric Association. Fourth annual convention, Vicksburg, Miss., May 28-30.

National Electric Light Association. Annual convention, Seattle, Wash., June 10-14.

Minnesota Electrical Contractors' Association. Annual convention, Duluth, Minn., June 16.

Michigan Section of the National Electric Light Association. Annual convention on board the *Majestic* sailing from Port Huron, Mich., about June 21.

American Institute of Electrical Engineers. Annual convention, Boston, Mass., June 25-28.

National Electrical Contractors' Association. Annual meeting, Denver, Colo., July 16-19.

The 1912 Boston Electric Show. Mechanics Building, Boston, Mass., September 28-October 26.

American Electric Railway Association. Annual convention, Chicago, Ill. October 7-11.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

With the Electrical Manufacturers

The Diehl Manufacturing Company, Elizabethport, N. J., has published bulletin No. 25, which is devoted to its 1912 line of electric fans. These include universal desk, bracket and oscillating fans, ceiling, column and counter fans, both of direct-current and alternating-current types.

Pass & Seymour, Inc., Solvay, N. Y., are sending out folders, calling attention to the reliability of Shurlock locking attachments for lamp sockets. These fit any of their sockets and insure against theft or unauthorized removal of lamps, shades or reflectors. The lock cannot be picked, as a special key is required to open it.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued folders Nos. 4100 and 4101 covering its 1912 line of fan motors. One of these folders is devoted to alternating-current fans and the other to direct-current fans. Attractive art covers add greatly to their appearance. The new line of steel-frame fans is well illustrated and described in these publications.

The Hemingray Glass Company, Covington, Ky., announces that Bertram M. Downs is now associated with that organization. Mr. Downs is one of the best known and most highly esteemed men in the electrical industry, and has had a long connection with the insulator field. He recently discontinued his association with the Brookfield Glass Company, New York, N. Y.

The Sangamo Electric Company, Springfield, Ill., has issued a complete treatise on induction meters, which will be of interest to central-station managers. Complete data are given as to the theory of operation, method of test, characteristic curves of induction meters under varying voltages, power-factor and frequency. The bulletin is exceptionally well illustrated and is a distinct addition to meter literature.

The Fostoria Glass Specialty Company, Fostoria, Ohio, has published an attractive 24-page bulletin devoted to its line of Veluria illuminating glassware. This glass, when cold, has the richness of white marble; when illuminated, it takes on a delicate ivory color and gives a soft, warm tone to the light. In the design of the reflectors consideration was given to both scientific and artistic requirements. The bulletin shows some of these typical designs. Artistic effects are secured not only by graceful outlines but, in many cases, by an ornate light etching on the glass that should appeal particularly to the feminine eye. The bulletin also gives valuable aid in calculating illumination problems and clearly defining illuminating terms. A copy of the bulletin may be obtained by anyone interested in illuminating glassware in whose production are incorporated both science and art.

The Keystone Electrical Instrument Company, Ninth Street and Montgomery Avenue, Philadelphia, Pa., has ready for distribution catalog No. 15. This describes and illustrates indicating and recording instruments for either direct or alternating-current circuits, and portable and switchboard types. The catalog is replete with well made illustrations, is handsomely printed, and should be in the hands of everyone requiring information respecting instruments of this character. The Keystone Electrical Instrument Company and its associate company, the Brown Instrument Company, manufacture a complete line of indicating and recording instruments for measuring temperature, electricity, speed, pressure, etc. Besides electrical instruments these companies manufacture thermometers, pyrometers, speed indicators, pressure gauges, tachometers, and other instruments. The company will be pleased to send catalogs illustrating any of these instruments to those interested upon request.

The American Conduit Company, East Chicago, Ind., has ready for distribution its 1912 edition of "Underground Conduit Construction." This is a 48-page pamphlet giving a fund of information on the advantages of underground ducts in general and particularly when constructed of Bitumenized Fiber. This publication is liberally illustrated with typical views and details of conduit installations. Many valuable data, costs and specifications are given. Methods of installing conduit for light and power, ornamental street lighting, telephone, telegraph and signal work are described. The company has also published as a separate folder an interesting article by A. G. McClure on ornamental street-lighting systems. This describes the value of such a system, the methods most successful for exploiting it and soliciting subscriptions, the costs involved and the best methods of installation. Central stations and other electrical public-utility companies contemplating underground construction should send for copies of these publications.

Record of Electrical Patents.

Issued by the United States Patent Office, March 19, 1912.

1,020,402. Electromagnetic Receiving Apparatus. J. B. M. P. H. R. d'Ivry, Paris, France. Has the coil around a tube containing a cylinder adapted to be raised and rotated.

1,020,441. Trolley Pole. J. Gaits, Jeannette, Pa. The trolley head is screwed into a special cap on top of the pole.

1,020,419 and 1,020,420. Time-Recording Device for Electric Trains. F. Hedley, Yonkers, and J. S. Doyle, New York, N. Y. A clock recorder electromagnetically governed by the motor and brake controllers to sum up the periods of acceleration and deceleration. In the second patent three similar but separate recorders are provided, to show the total time the controller was on, the time the brake was on, and the time of coasting.

1,020,429. Lightning Arrester. L. T. Lineberger, Gastonia, N. C. Has ground and line carbons and knives to scrape the faces of each.

1,020,439. Electric Singeing Instrument. H. Y. Norwood, Rochester, N. Y. Has the resistance element partly surrounding and partly passing through the body.

1,020,457. Universal Binding Post. A. K. Sloan, Jr., Brooklyn, N. Y. Includes a clamping washer with wire-receiving grooves in its face.

1,020,479. Electric Regulation. J. L. Creveling, assignor to Safety Car Heating & Lighting Co. An axle-driven car-lighting system has a lamp-circuit regulator interconnected with the storage-battery regulator.

1,020,480. Means for Preventing Corrosion of Surface Condensers and Other Metal Structures. P. E. G. Cumberland, assignor to A. Markell, Sydney, Australia. A source of electricity has its negative terminal connected to the shell and its positive terminal to several anodes within the condenser.

1,020,503. Ignition Device. D. Holden, Upper Montclair, N. J. A jump-spark ignition plug for an internal-combustion engine.

1,020,518. Motor Vehicle. E. S. Sandgren and C. F. Case, assignors to Oliver Motor Car Co., Detroit, Mich. Relates to the construction of an automobile chassis and a special mounting for the ignition generator.

1,020,520. Circuit-Closing Apparatus. H. W. Sheehy, Akron, Ohio. An electromagnetically actuated railway-switch-operating device.

1,020,522. Circuit-Making and Breaking Device. W. A. Stiles, Philadelphia,

Pa. A rotating notched cam moves a contact arm against a stationary contact.

1,020,540. Trolley Wheel. F. M. Cummings, Byesville, O. Two of the four spokes of the wheel are detachable so that the hub and rim may be separated.

1,020,541. Instrument for Testing Batteries. C. J. Davidson, assignor to American Telephone & Telegraph Co. A pocket watch-case ammeter for testing dry cells with telephone transmitters.

1,020,546. Process of Smelting Ores and Apparatus Therefor. R. Fleming, Westfield, N. J. A polyphase electric furnace with the electrodes around the lower part of a vertical heating chamber.

1,020,555. Signal. A. J. Horton, assignor to Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Consists of two pilot lamps, one normally in circuit and the other connected in on failure of the first.

1,020,565. Meter for Measuring Electrical Currents. A. Loewenberg, Chicago, Ill. An ammeter or voltmeter of the D'Arsonval type with brass keepers for holding the ion core between the poles of the permanent magnet.

1,020,566. Electric Motor. J. F. McKinzie, R. E. McKinzie and J. B. Clark, La Salle, Ill. Has a rocking commutator connected with the field magnets so these may be energized or de-energized.

1,020,603.—Electric Treeing Iron.

1,020,568. Alkaline Battery. W. Morrison, Des Moines, Ia. The active material for the positive plate of a storage battery consists of oxides of mercury, copper and silver.

1,020,603. Electrically Heated Tool. J. S. Hansen, assignor to D. A. Miller Treeing Machine Co., Portland, Me. A treeing iron with handles on opposite sides of a hollow body containing a removable heating element.

1,020,606. Electric Damper Control. F. Huff, Napa, Cal. An electromagnet actuates an armature on a balancing damper beam.

1,020,607. Motor Truck. C. W. Hunt, New York, N. Y. (deceased), by K. H. Hunt, C. W. Hunt and G. S. Humphrey, executors. The motor is mounted on an underhung extension of the truck frame and is connected to the driving axle by worm gearing.

1,020,688. Induction Furnace. R. Fleming, assignor to General Electric Co. Has its primary coil movable toward or away from the crucibles.

1,020,698. Electrolytic Interrupter. J. R. Kelley, Covington, Ky. The interrupting electrode is sealed into a non-conducting stem with but a small surface exposed.

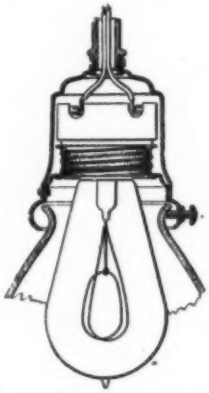
1,020,707. Steering Device for Automobiles. H. Lemp, assignor to General Electric Co. The steering mechanism controls switches for electromagnetic clutches that connect the driving motor with each of the rear wheels.

1,020,711. Electric Lamp Fixture. F. L. Raynor, Southampton, N. Y. The fixture stem consists of a number of pairs of parallel tubular links through which the circuit wires are flexibly threaded.

1,020,732. Reversible Lamp Base. T. A. Willard, Cleveland, O. Within the shell are two pairs of contact plungers, one serving for a lamp at one end of the base and the other for an attachment plug.

1,020,736. Combined Electric Socket and Shade-Holder and Socket-Cover. L. W. Anderson, assignor to Plume & Atwood Manufacturing Co., Waterbury, Conn. The holder flange is secured between a socket ring and the cover flange.

1,020,768. Alarm-Signal Device. Ray H. Manson, assignor to Dean Electric Co., Elyria, O. The diaphragm of the horn is electromagnetically vibrated.



1,020,736. Combined Socket, Shell and Shade-Holder.

1,020,794. Trolley. C. A. Bluhm, Michigan City, Ind. Has a short pivoted arm and harp to permit the motorman to raise it from the third rail.

1,020,813. Mechanism for Diffusing Light. V. E. Eslon, Tacoma, Wash., assignor of one-half to C. Olsen. A horizontal frame carrying several incandescent lamps is revolved about a vertical axis so as to form illuminated zones merging into each other.

1,020,818. Electrical Switch Means. H. L. Furr, Harrisonburg, Va. Has superposed pairs of multiple contacts over which circuit-making elements shift.

1,020,828 and 1,020,829. Electric Washing Machine. W. D. Jones, New York, N. Y., assignor of one-third to W. A. Rees and one-third to R. L. Rees. Within a tank is a revolving perforated cylinder and opposite sets of electrodes to cause currents to pass through the liquid in different planes.

1,020,880. Insulator. A. M. Bourke, Maitland, N. S. W., Australia. The wire is held in a diametrical slot over which is a wedge and on top of all a cap.

1,020,897. Automatic Time-Controlled Regulator for Gas Engines. W. C. Gambrel, Tabor, Ill. Dropping of weight opens the ignition switch and closes the throttle.

1,020,898. Telephonic Apparatus. E. A. Graham, Brockley, Eng. Includes a buzzer call and a loud-speaking receiver.

1,020,942 and 1,020,943. Levitating Transmitter Apparatus. E. Bachelet, Mount Vernon, N. Y. Consists of a set of electromagnets energized in turn to attract and propel the carrier along the way.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 26, 1912.

536,210. Electrical Signaling Apparatus. W. E. M. Jackson, San Francisco, Cal.

536,221. Electric Switch. C. J. Miller, Philadelphia, Pa.

536,226. Magnetic Separator. J. D. McKinnon, Portland, Ore.

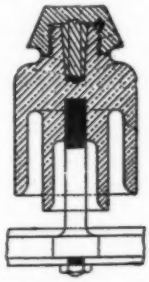
536,233. Telephone System. J. I. Sabin and W. Hampton, San Francisco, Cal.

536,256. Electric Railway Switch. R. A. Baldwin, South Norwalk, Conn.

536,266. Electric Switch. C. C. Chesney, Pittsfield, Mass.

536,271. Electrical Signal and Switch-Operating Apparatus. J. Dutrey, New Orleans, La.

536,275. Supply System for Electric Railways. C. E. Emery, Brooklyn, N. Y.



1,020,880.—Insulator.

536,319. Method of Insulating High-Tension Coils of Transformers. A. Schneller, Aarlanderveen-Alten, and W. J. Wisse, Haarlem, Netherlands.

536,374. Conduit Electric Railway. F. S. Davenport, Jerseyville, Ill.

536,382. Telephone-Exchange System. S. W. Holman, Boston, Mass.

536,411. Velocipede Provided with Electrical Communicatng Apparatus. R. H. Wolff, New York, N. Y.

536,420. Telegraphy. P. B. Delany, South Orange, N. J.

536,438. Electric Mining Machine. E. C. Morgan, Chicago, Ill.

536,439. Armature for Electric Machines. E. C. Morgan, Chicago, Ill.

536,467. Electric Signal System. W. Gillette, New York, and A. S. Williams, Long Island City, N. Y.

536,478. Combination Electrical Meter. H. C. Parker, Brooklyn, N. Y.

536,481. Telephone. J. D. Price, Chicago, Ill.

536,530. Electric Current Regulator. C. M. Jordan, Washington, D. C.

536,535. Electric Brake. E. D. Lewis, Savona, N. Y.

536,547. System of Electrical Signaling for Railways. C. Selden, Baltimore, Md.

536,559. Relay. C. R. J. Willot, Paris, France.

Reissue No. 11,481. Closed-Conduit Electric Railway. William Lawrence, New York, N. Y.